Joshua Sturges

THE

KEY

TO THE

TUTOR's GUIDE:

OR THE

ARITHMETICIAN's REPOSITORY.

CONTAINING

The SOLUTIONS of the QUESTIONS, &c.
in the TUTOR's GUIDE.

With the REFERENCES as they ſtand in the Seventh Edition.

To which is added *(where neceſſary)*

Some USEFUL RULES, &c.

Likewiſe

AN APPENDIX.

Shewing the Combination of Quantities; the different Ways they may be varied; with the Method of filling the Magic Squares, &c.

The Whole being principally deſigned for the Eaſe of Schoolmaſters, and, with the GUIDE, furniſhes a more Complete and Extenſive SYSTEM of ARITHMETIC, than any extant; and will enable all thoſe who are acquainted with the firſt Principles to attain a competent Knowledge of the ſeveral Rules, with Eaſe and Preciſion.

The FIFTH EDITION, carefully reviſed and corrected.

By CHARLES VYSE.

LONDON,
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M,DCCXCI.

BRITISH MUSEUM

THE

PREFACE.

WHAT gave Riſe to the following Sheets, was my receiving Letters from ſeveral eminent Mathematicians, and Schoolmaſters, wherein they expreſſed great Deſire for ſuch a Performance, mentioning the Utility ſuch a Work would be to Schoolmaſters in general; as the TUTOR'S GUIDE contained ſuch a Variety of Queſtions, ſuitable to all Capacities, and adapted for the Uſe of the Gentleman and Scholar, as well as for the Man of Buſineſs.—But as many of the Queſtions are long and difficult, made it impoſſible for Schools in general to make Uſe of the GUIDE, without the KEY, the Time in Schools not admitting; therefore they gave me great Hopes of Encouragement, by promiſing to make Uſe of the TUTOR'S GUIDE in their own Schools; beſide recommending it to all Schoolmaſters in Great-Britain, as the moſt complete Epitome of Arithmetic, or Queſtion Book, extant; and, with the KEY, would enable the Tutor to inſtruct ten Pupils with greater eaſe, more correctly, and with leſs Perplexity both to himſelf and Scholars, than one by any other Book. Thus encouraged, and at the ſame Time being ſenſible of the favourable Reception the GUIDE has met with, gives me great Hopes that the following Pages will meet with that Encouragement, due to ſo uſeful and laborious a Work.

The Title Page gives a ſhort Account of what the following Pages contain, which I think needleſs to enlarge upon, therefore ſhall leave the Book to ſpeak for itſelf; and if it does not give ſatisfaction to the Reader, I am ſure all I can ſay in its behalf will never recommend it: but this may be juſtly ſaid, whoever reads it over, will find the Solutions of a greater Variety of Queſtions than in any other Treatiſe on the ſame Subject; and are performed in as intelligible, and comprehenſive a Manner, as my Bounds would admit of, or even as is neceſſary.

How well I have performed this Work, muſt be left to proper Judges; and as I am not ſenſible of any fundamental Error in the following Pages, yet I cannot pretend to ſay it is without Imperfections; which I hope the good-natured Reader will excuſe, and paſs over with the like Candour and Good-will, with which it was compoſed for his Uſe, by

CHARLES VYSE.

This Edition ſerves alſo for a little Book entitled, the Scholar's Companion, (Price 2s.) being an Abridgement of the Tutor's Guide, containing every Rule neceſſary for the firſt Form, or Youth deſigned for Trade. As I am anxious of making this Book as perfect and complete as poſſible, I moſt earneſtly requeſt, that if any of my Readers ſhould diſcover any Defect in it, that they will be ſo obliging as to favour me with a Line, which ſhall be carefully attended to in the next Impreſſion.

6 JU 62

To

To Mr. CHARLES VYSE.

SIR,

YOUR valuable Treatiſe on Arithmetic, as ſoon as it came from the Preſs, was immediately introduced into my School, where I have continued to uſe it ever ſince; and look upon it as exceedingly well calculated to facilitate the Buſineſs of a School, in thoſe Branches of Learning of which it treats.

A ſecond Edition falling into my Hands, it gave me great Pleaſure to find by your Preface thereto, that you had ſome Thoughts of giving us (in a ſeparate Publication) the Solutions to all the Queſtions at large; which would be in my Opinion of great Uſe to the Maſter, and what I wiſh of all things to hear you have done. I immediately wrote to my Bookſeller, for the Key to your Book, but received for Anſwer, it was not in Print; which has induced me to give you this Trouble, to know whether that be really the Caſe; and whether I may expect ever to ſee ſo excellent a Syſtem of School Inſtructions rendered complete, by the Publication of the Key, &c.

I am, Sir,

Your moſt obedient humble Servant,

Sept. 16, 1773.

CHRISTOPHER CAVE,

Maſter of the Free-School at Caiſter, in Lincolnſhire.

To Mr. CHARLES VYSE.

SIR,

I Purchaſed your ſecond Edition of the Tutor's Guide ſome Time ago, with a View of being furniſhed with a complete Syſtem of Arithmetic, when the Key ſhould be publiſhed; and have been very impatient for ſo uſeful a Performance, being ſenſible of the Utility ſuch a Work muſt be to the Maſters in general, particularly to all thoſe who have the Care of a numerous School; I beg you will inform me whether the Key is (already, or intended to be) publiſhed; and you will highly oblige

Your humble Servant,

and well wiſher,

Plumpton,
June 12, 1773.

ISAAC SLEE,

School-Maſter at Plumpton, in Cornwall.

To Mr. CHARLES VYSE.

SIR,

I Cannot help thanking you for the Pains you have ſo happily employed for the facilitating of the Science of Numbers.

Solutions of Mr. Clare's very ingenious Queſtions have been much wanted; and it muſt certainly afford great Satisfaction to every Lover of Figures to find that Taſk ſo well executed.

I am, Sir,

6 JU 62

Your obliged humble Servant,

July 14, 1774.

SAMPSON WRIGHT,

Maſter of the Free Grammar-School of Bradley,
near Stafford.

WE have alſo received Letters to the ſame Purport from the following Gentlemen, viz. Mr. Rigge, Writing-Maſter and Land-Surveyor, at Cambridge; Mr. Roſs, Author of the Inſtructor's Aſſiſtant, at Portſmouth; Mr. Boome, School-Maſter, at Putney; Mr. ——, Maſter of the Boarding School at St. Edmund's-Bury; the Rev. Mr. Holiday, of Lincolnſhire; likewiſe from ſeveral others, whoſe Letters being miſlaid, their Names are forgot.

* * *

THE
KEY
TO THE
TUTOR's GUIDE:
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ARITHMETICIAN's REPOSITORY.

BOOK I. PART I.

7. NUMERATION.

Numbers expreſſed in Words.

NINETY-FOUR; ſeven hundred and ſixty-two; three thouſand and twenty-four; thirty ſeven thouſand four hundred and ſixty; one hundred forty-two thouſand, ſix hundred and thirteen; ſix million, forty thouſand, three hundred and ninety; forty-ſeven million, ſix hundred thirty-nine thouſand, one hundred and twenty-one; ſeven hundred ninety million, four hundred one thouſand, nine hundred and fifty; ſeventy-nine million, forty-one thouſand, nine hundred and fifty-five.

Words expreſſed in Figures.

77, 490, 6055, 17709, 800002, 7044074, 694400060.

Roman Numerical Letters expreſſed in Figures.

19, 200, 600, 560, 1001, 1750, 70000, 110000, 1500000, 1600000.

Common Figures expreſſed in Numerical Letters.

XXIX. CIV. CCCCXIX. MDCCXLI. MMVII. $\overline{\text{XVII}}$DCLXXVIII. $\overline{\text{XIV}}$. $\overline{\text{DCLXXIV}}$LXXXIV.

INTEGERS.

2. ADDITION.

To add theſe Examples I begin with the firſt, and ſay 6 and 7 is 13, and 6 is 19, and 4 is 23, and 2 is 25. and 9 is 34; this is the Amount of the firſt Row, or Unit's Place, which contains 3 Tens, and 4 over; this 4 I ſet under the Row, and carry 3 to the next Row or Ten's Place, ſaying 3 that I carry and 4 is 7, and 1 is 8, and 9 is 17, and 1 is 18, and 4 is 22, and 7 is 29, this being 2 Tens and 9 over, therefore I ſet down 9 and carry 2 to the next Row or Hundred's Place, ſaying 2 and 7 is 9, and 4 is 13, and 1 is 14, and 9 is 23, and 2 is 25, which is 5 to ſet down, and I carry 2 to the fourth Row, or Place of Thouſands, ſaying 2 and 4 is 6, and 7 is 13, and 2 is 15, and 6 is 21, and 4 is 25, and 7 is 32, which is 2 to ſet down, and I carry 3 to the fifth Row, or Place of Tens of Thouſands, and find that it alſo amounts to 32, when I ſet down the odd 2, and carry 3 to the ſixth and laſt Row, or Place of Hundreds of Thouſands, and find that it amounts to 22, and as this is the laſt Row, I ſet down the whole 22, that is, the 2 under the Row and the two Tens I carry to the Left Hand, and in the ſame Manner proceed with the reſt of the Examples.

(1) 2222594 (2) 696237 (3) 433968 (4) 225879

(5) 2181162 (6) 326034 (7) 34[illegible]780 (8) 886220054

(9) 1148103

3. SUBTRACTION.

When the upper Figure is greater than the lower, as in the firſt Example, I ſay 0 from 2 there remains 2; then 2 from 4 there remains 2, and 6 from 7 there remains 1; in this Manner proceed to the End of this Example. But when the lower Figure is larger than the top one, as in the ſecond Example, I ſay 7 out of one I cannot have, therefore I take 7 out of 10, (which I borrow) and there remains 3, and the top Figure 1 makes 4, which I place under the Unit's Place, and carry 1 to the next lower Figure, ſaying that 1 I carry to 6 makes 7, then 7 from 4 I cannot, but 7 from 10, there remains 3, and the top Figure 4 makes 7 to ſet down, and 1 to carry to the next lower Figure, which is 4, makes 5; then ſay 5 from 9 there remains 4; but now I do not carry any to the next Figure, becauſe I do not borrow, but only ſay 7 from 4 I cannot, but 7 from 10 there remains 3, and the top Figure 4 makes 7 to ſet down, and 1 I carry to 0 is 1, from 0 I cannot, but 1 from 10 there remains 9, and carry 1 to 8 is 9, from 7 I cannot, but 9 from 10 there remains 1, and the top Figure 7 makes 8; laſtly, 1 I carry from 1, and there remains 0, which being the laſt Figure, I do not ſet it down; and in this Manner proceed with the other Examples.

(1) 221122 (2) 897474 (3) 689796 (4) 3160990

(5) 313992 (6) 2708970 (7) 8960066 (8) 3320801

(9) 1069897 (10) 31981794 (11) 106799280

4. MULTIPLICATION.

CASE I.

I begin with the firſt Example, and ſay, twice 3, or 2 Times 3, is 6 to ſet down; then twice 5 is 10, that is 0 to ſet down, and carry 1; then twice 8 is 16, and 1 I carry is 17, that is 7 to ſet down, and I carry 1; then twice 9 is 18, and 1 I carry is 19, that is 9 to ſet down, and 1 to carry to the next Figure; and ſo I proceed to the End of this Example, and likewiſe with all the reſt, always remembering to carry 1 for every 10 to the next Figure on the Left Hand, as in Addition.

(1) 8352197060 (2) 1028157258 (3) 1030723656

(4) 8710284150 (5) 1025792286 (6) 5244299221

(7) 2102064752 (8) 33866176050

CASE II.

(9) 856424376
142737396
2283798336

(10) 172859776
43214944
605009216

(11) 84537943
108691641
1171454353

(12) 1237835
1732969
990268
117594325

(13) 2858841
2541192
1905894
218860161

(14) 16241490
10827660
18948405
8120745
10140103590

(15) 295356
1181424
886068
738390
839106396

(16) 47269
378152
236345
141807
330883
3478100289

(17) 662229
441486
147162
515067
294324
3478100289

(18) 4585548
6878322
2292774
5349806
764258
3057032
318998232168

(19) 3339168
2086980
834792
1669584
2504376
2921771
318998232168

(20) 16314384
8157192
19033448
21752512
10876256
16314384
13595320
15359274703104

CASE III.

(21) 85968376
10746047
53730235
42984188
435216064073076

(22) 7242305625
6437605000
5632904375
1609401250
166579474222305625

CASE IV.

(23) 102263
116872
12709830000

(24) 16608
11072
5536
68092800000

CASE V.

(25) 24674
4×4=16
98696
4
394784

(26) 340764
7×4=28
2385348
4
9541392

(27) 142395
8×7=56
1139160
7
7974120

(28) 176848
9×9=81
1591632
9
14324688

(29) 420746
9×8=72

3786714
8

30293712

(30) 17093
9×7=63

153837
7

1076859

(31) 43074
12×12=144

516888
12

6202656

(32) 14068
12×11=132

168816
11

1856976

CASE VI.

To perform the Examples in this Caſe, I begin with the laſt, and ſay, 9 times 8 is 72, put down 2 and carry 7; then 9 times 6 is 54, and 7 I carry is 61, and the Right Hand (or back) Figure 8 is 69, put down 9 and carry 6; then 9 times 7 is 63, and 6 I carry is 69, and 6 the back Figure is 75, put down 5 and carry 7; then 9 times 2 is 18 and 7 I carry is 25, and 7 the back Figure is 32, put down 2 and carry 3; then 9 times 4 is 36, and 3 I carry is 39, and 2 the back Figure is 41, put down 1 and carry 4; then 9 times 1 is 9, and 4 I carry is 13, and 4 the back Figure is 17, put down 7 and carry 1. Now as the Multiplication by the 9 (the Unit's Figure) is ended, I add the 1 I carry to the laſt Figure in the Multiplicand, and it makes 2, which I put down, and the Work is ended; and in this Manner proceed with all the reſt of the Examples in this Caſe.

(33) 1569876 (34) 171312 (35) 1899222 (36) 338464

(37) 542130 (38) 2822784 (39) 248353 (40) 335286

(41) 2712592

5. SECT. V. DIVISION.

CASE I.

In the firſt Example I begin and ſay, How oft 2 in 17? Anſwer, 8 times 2 is 16, and 1 over, which is 10, added to 4 the next Figure, makes 14; then I ſay how oft 2 in 14? Anſ. 7 times 2 is 14, and 0 over; how often 2 in 2? Anſwer, 1 and 0 over; how oft 2 in 6? Anſ. 3 times 2 is 6, and 0 over; how often 2 in 3? Anſ. 1 and 1 over, which is 10, and the next Figure 6 is 16; how oft 2 in 16? Anſ. 8 times 2 is 16, and nothing remains; and in this Manner proceed with all the reſt of the Examples in this Caſe.

(1) Quotient 871318 (2) 921354—2 (3) 540185—2
2

Proof 1742636 (4) 215185—1 (5) 11903492—2

(6) 667751—6 (7) 346012 (8) 752010—4

(9) 251160—4 (10) 23040—4

CASE II.

To perform this Caſe I begin with the firſt Example, and ſay, How oft is 25 in 73; or, which is better, how oft 2, the firſt Figure in the Diviſor, in 7, the firſt in the Dividend, and I find (after the Allowance is made for what I ſhall have to carry) it will only go 2 times; wherefore I place 2 in the Quotient, and multiply 25 the Diviſor thereby, the Product (viz. 50) ſet under 73, and ſubtract; then to the Remainder 23 I bring down the next Figure 6 in the Dividend; then I ſay (as before) how oft 2 in 23? Anſwer, 9 times, which I place in the Quotient, and multiply (25) the Diviſor thereby, the Product, viz. 225 ſubtracted from 236 leaves 11, to which bring the next Figure in the Dividend, viz. 4, then proceed as before, till you have brought down all the Figures in the Dividend, and the Work will be finiſhed.

Diviſor.

```
Diviſor. Divid. (11) Quot.                 (12)
  25)736473575(29458943        84)35730972(425368 60/84
     50                5          336
     --          ---------        ---
     236         147294715        .213
     225                 5         168
     ---         ---------         ---
    .114     Pr. 736473575        .450
     100         ---------         420
     ---                           ---
    .147                          .309
     125                           252
     ---                           ---
    .223                          .577
     200                           504
     ---                           ---
    .235                          .732
     225                           672
     ---                           ---
    .107                  Remains   60
     100
     ---
    ..75
    ..75
     ---
      ..
```

```
       (13)                            (14)
648)272357640(420305          759)30891829676(40700697
    2592                          3036
    ----                          ----
    .1315                         ..5318
    1296                            5313
    ----                          ------
    ..1976                        ...5296
      1944                           4554
      ----                        -------
    ..3240                           .7427
      3240                            6831
      ----                           -----
      ....                           .5966
                                      5313
                                      ----
                              Remains .653
```

(15)
3065)634639022247(20706003
6130
. 21639
21455
. . 18402
18390
. . . 12247
9195
Remains 3052

(16)
7489)1204530760(160848
7489
. 45563
44934
62907
59912
29956
29956
0

(17)
42163)11273728(2673
84326
. 284113
252978
. 311352
295141
. 162118
126489
Remains . 35629

(18)
61745)392628787(6358
370470
221587
185235
. 363528
308725
548037
493960
Remains . 54077

(19)

```
          (19)                              (20)
684573)3233238699(4723      476085)98839054780(207608
       2738292                      952170
       -------                      -------
       4949466                      3622054
       4792011                      3332595
       -------                      -------
      .1574559                     .2894597
       1369146                      2856510
       -------                      -------
      .2054139                    ..3808780
       2053719                      3808680
       -------                      -------
Remains....420               Remains....100
       -------                      -------
```

```
                 (21)
       4728395)27750950255(5869
               23641975
               --------
              .41089752
               37827160
               --------
              .32625925
               28370370
               --------
              .42555555
               42555555
               --------
               .......
```

CASE III.

```
       (22)                                      (23)
28,00)119282,48(4260         172,000)247004,674(1436 12674/172000
      112            2800            172
      ---            ----            ---
       72         3408248           .750
       56         852                688
      ---         -------            ---
      168        11928248 Proof.    .620
      168        --------            516
      ---                            ----
Rem....248                           1044
                                     1032
                                     ----
                          Remains .. 12674
```

(24)

473000)351858,000(743$\frac{419}{473}$
3311
. 2075
1892
. 1838
1419
Remains 419|000
473|000

(25)

697,0000)59943,0000(86$\frac{1}{697}$
5576
. 4183
4182
Remains 1|0000
697|0000

C A S E IV.

(26)

$$16\left\{\begin{array}{l}4)1206816\\ \hline 4)\ 301704\end{array}\right.$$

Quot. 75426

(27)

$$48\left\{\begin{array}{l}6)42768\\ \hline 8)\ 7128\end{array}\right.$$

891

(28)

$$72\left\{\begin{array}{l}8)74682\\ \hline 9)\ 9335-2\end{array}\right.$$

$$\left.\begin{array}{l}9335-2\\ \hline 1037-2\end{array}\right\}\ 18\text{ R.}$$

(29)

$$144\left\{\begin{array}{l}12)14276\\ \hline 12)\ 1189-8\end{array}\right.$$

$$\left.\begin{array}{l}1189-8\\ \hline 99-1\end{array}\right\}\ 20\text{ Rem.}$$

(30)

$$28\left\{\begin{array}{l}4)247684\\ \hline 7)\ 61921\end{array}\right.$$

$8845-6=6\times4=$
24 R.

(31)

$$64\left\{\begin{array}{l}8)14652\\ \hline 8)\ 1831-4\end{array}\right.$$

$$\left.\begin{array}{l}1831-4\\ \hline 228-7\end{array}\right\}\ 60\text{ Rem.}$$

(32)

$$81\left\{\begin{array}{l}9)417681\\ \hline 9)\ 46409\end{array}\right.$$

$5156-5=5\times9=$
45 R.

(33)

(33)

132 { 11)307684
12) 27971—3 }
2330—11 } 124 Remains.

CASE V.

(34)
17)690489(40617
104
28
119
...

(35)
86)5343698(62136
183
116
309
518
Remains 2

(36)
467)2148686(4601
.2806
486
Remains 19

(37)
6074)24939844(4106
6438
36444
.....

6. REDUCTION.

MONEY.

(1) 27 £.
20
540 Shillings.
12
6480 Pence.

(2) 12)6480 Pence.
2,0) 54,0 Shillings.
27 £.

£. s.
(3) 40 10
20
810 Shillings
12
9720 Pence.
4
38880 Farthings.

qrs.
(4) 4)38880
12)9720
20)81,0
£. 40 10.

£. s. d.
(5) 104 17 6¾
20
2097 s.
12
25170 d.
4
100683 Farthings.

qrs.
(6) 4)100683
12)25170¾
2,0)209,7—6
£. 104 17 6¾

(7) 21 Guineas
7×3=21*s.*=1 Guin.
147
3
441 Shillings.
12
5292 Pence.
4
21168 Farthings.

(8) 4)21168 qrs.
12)5292
$21\begin{cases}3)441\\7)147\end{cases}$
21 Guineas.

(9) 42 *Moidores.*
9×3=27s.=1 Moid.
378
3
1134 Shillings.
12
13608 Pence.
4
54432 Farthings.

(10) 4)54432 *qrs.*
12)13608 d.
27 { 3)1134 s.
9) 378
42 Moid.

WEIGHTS, MEASURES, &c.

TROY-WEIGHT.

(1) 24 *lb.*
12
288 oz.
20
5760 dwts.
6×4=24
34560
4
138240 grs.

(2) 24 { 4)138240 *grs.*
6) 34560
2,0)576,0 dwts.
12)288 oz.
24 lb.

lb. oz. dw. grs.
(3) 12 10 0 22
12
154
20
3080
6×4=24
18480
4
73942 grs.

grs.
(4) 24 { 4)73942
6)18485—2
2,0)308,0—5 } 22 grs.
12)154
lb. 12 10 0 22

(5

APOTHECARIES WEIGHTS.

(5) 14 lbs.
12
168 ℥
8
1344 ʒ
3
4032 ℈
20
80640 grs.

(7) *lb.* ℥ ʒ ℈ *grs.*
4 11 0 2 17
12
59 ℥
8
472 ʒ
3
1418 ℈
20
28377 grs.

(6) 2,0)8064,0 grs.
3)4032 ℈
8)1344 ʒ
12)168 ℥
14 lb.

(8) 2,0)2837,7 grs.
3)1418—17 grs.
8)472—2℈
12)59
lb. 4 11 0 2 17

AVOIRDUPOISE WEIGHT.

(9) 20*C.*
4
80 qrs.
28
2240 lb.
16
35840 oz.
16
573440 drs.

(10)
16 { 4)573440 *drs.*
4)143360 }
16 { 4)35840 oz.
4) 8960 }
28 { 4)2240 lb.
7) 560 }
4)80 qrs.
20 C.

lb. oz. drs.
(11 27 12 11
16
444
16
7115 drs.

drs.
(12)
16 { 4)7115
4)1778—3 }
16 { 4)444—2 }
4)111
} 11 drs.
lb. 27 12 11.

T. C. qrs. lb. oz. drs.
(13) 12 10 0 14 11 15
20
250 C.
4
1000 qrs.
28
28014 lb.
16
448235 oz.
16
7171775

(14)
16 { 4)7171775 drs.
4)1792943—3 }
16 { 4)448235—3 } 15 drs.
4)112058—3 }
28 { 4)28014—2 } 11 oz.
7) 7003—2 }
4)1000—3 } 14 lb.
2,0)25,0
Tons 12 10 0 14 11 15

CLOTH MEASURE.

(15) 24 yds.
4
96 qrs.
4
384 nails.

(16) 4)384 nails
4)96 qrs.
24 yards.

E.E. qrs. na.
(17) 72 4 2
5
364 qrs.
4
1458 nails.

(18) 4)1458 nails.
5)364—2.
E. Ells 72 4 2

(19) 121 Fl. ells
3
363
4
1452 nails.

(20) 4)1451 nails
3)363
121 Fl. E.

Fr. E. qrs.
(21) 42 5
6
257 qrs.
4
1028 nails.

(22) 4)1028 nails.
6)257 qrs.
Fl. E. 42 5 0

LONG MEASURE.

M. F. P.
(23) 176 0 30
8
1408 Fur.
40
56350 Poles.

(24) 4,0)5635,0 Poles.
8)1408—30 P.
Miles 176 0 30 P.

(25) 200 Miles,
1760

352000 Yards.
3

1056000 Feet.
12

12672000 Inches.

(26) 12)12672000 Inches.

3)1056000 Feet

176,0)35200,0(200 Miles.
352

...00

Lea. m. fur. p. y.
(27) 12 1 6 29 4
3

37 Miles.
8

302 Fur.
40

12109 Poles.
11 Half Yds. in a Pole.

133207 Half Yds.
18 Inches=½ Yd.

2397726 Inches.
3

7193178 Barley Corns.

B. C.
(28) 3)7193178

18 { 3)2397726 Inches.
6) 799242

11)133207 half Yds.

4,0)1210,9—8=4 Yds.

8)302—29 P.

3)37—6 Fur.

Lea. 12 1 6 29 4

LAND MEASURE.

(29) 42 Acres.
4

168 Roods.
40

6720 Poles.

(30) 4,0)672,0 Poles.

4)168 Roods.

42 Acres.

(31)

(31)
A. *r.* *p.*
12 3 29
4
51 Roods.
40
2069 Poles.

(32)
4,0)206,9 Poles.
4)51—29 P.
A. 12 3 29

WINE MEASURE.

(33)
4 Anchors.
10
40 Gal.
4
160 Qts.

(34)
4)160 Qts.
1,0)4,0 Gal.
4 Anchors.

(35)
4 Hhds.
63
252 Gal.
8
2016 Pints.

(36)
8)2016 Pints.
63 { 7)252
9) 36
4 Hds.

(37)
Tierce, gal.
42 24
7×6=42
294
6
1788 Gal.
8
14304 Pints.

(38)
8)14304 Pints.
42 { 6)1788
7) 298
Tierce 42 24

(39)

T. p. hd. gal. pts.
(39) 4 1 1 42 6
2
9 Pipes.
2
19 Hhds.
63
1239 Gal.
8
9918 Pints.

(40) 8)9918 Pints.
63 { 7)1239—6 Pints.
9) 177
[illegible]
2)19—42 Gal.
2)9—1 hhd.
Tuns. 4 1 1 42 6

WINCHESTER MEASURE.

(41) 12 *B. A.*
32
384 Gal.
4
1536 Quarts,

(42) 4)1536 Qts.
32 { 4)384 Gal.
8)96
12 Barrels.

(43) 42 *B. B.*
9+4=36
378
4
1512 Gal.
8
12096 Pints.

(44) 8)12096 Pints.
36 { 4)1512 Gal.
9) 378
42 Barrels.

A. hds. gal. pts.
(45) 6 27 6
48
315 Gal.
8
2526 Pints.

(46) 8)2526 Pints.
48 { 6)315—6 Pints:
8)52—3 }
6—4 } 27 Gal.
Hhds. 6 27 6

B. hhd. gal.
(47) 14 47
54

803 Gal.
[illegible]

6424 Pints.

(48) 8)6424 Pints.

54 { 6)803 Gal.
9)133—5 } 47 Gal.
14—7

Anſw. 14 Hhds. 47 Gal.

T. b. hd. gal.
(49) 6 1 0 42
2

13 B.
2

26 Hhds,
9×6=54

234
6

1446 Gal.
4

5784 Qts.

(50) 4)5784 Qts.

54 { 6)1446
9) 241
2)26—7 } 42 Gal.
2)13

T. 6 1 0 42

DRY MEASURE.

(51) 24 Qrs.
8

192 Buſh.
4

768 Pecks.
2

1536 Gal.
4

6144 Qts.

(52) 4)6144 Qts.

2)1536 Gal.

4)768 Pecks.

8)192 Buſh.

24 Qrs.

Cha. bu.
(53) 36 26
6×6=36
216
6
1322 Buſh.
4
5288 Pecks.

(54) 4)5288 Pecks.
36 { 6)1322 Buſh.
6)220—2 }
36—4 } 26 Buſh.
Anſw. 36 Ch. 26 Buſh.

(55) 64 Laſts.
2
128 Weys.
5
640 Qrs.
8
5120 Buſh.
4
20480 Pecks.

(56) 4)20480 Pecks.
8)5120
1,0)64,0 Qrs.
64 Laſts.

TIME.

(57) 7 Days.
24
168 Hours.
60
10080 Min.
60
604800 Seconds.

(58) 6,0)60480,0 Seconds.
6,0)1008,0 Min.
24 { 4)168 Hours.
6)42
7 Days.

M. d.
(59) 6 4
28
172 Days.
6×4=24
1032
4
4128 H.
60
247680 M.
60
14860800 Sec.

(60) 6,0)1486080,0 Seconds.
6,0)24768,0 M.
24 { 4)4128 H.
6)1032
7)172 D.
4) 24—4
M. 6 4 D.

D. H.
(61) 365 6
6×4=24
2190
4
8766 H.
60
525960 M.
60
31557600 Seconds.

(62) 6,0)3155760,0 Sec.
6,0)52596,0 M.
24 { 4)8766
6)2190—6
365 D. 6 H.

(63) *D. h. m.* ″ ‴
365 5 48 57 39
6×4=24
2190
4
8765 H.
60
525948 M.
60
31556937 Sec.
60
1893416259 Thirds.

(64) 6,0)189341625,9 Thirds.
6,0)3155693,7—39‴
6,0)52594,8—57″
24 { 4)8765—48′
6)219—5 H. }
Days 365 5 48 57 39

SQUARE OR SUPERFICIAL MEASURE.

(65) 42 Yards.
9
378 Feet.
12×12=144
4536
12
54432 Inches.

(66) 144 { 12)54432 Inches.
12)4536 }
9)378 Feet.
42 Square Yards.

(67) *Sq. f. in.*
3 42 64
100
342 Feet.
12×12=144
4104
12
49312 Inches.

(68) *Sq. in.*
144 { 12)49312
12) 4109—4 }
1,00)3,42—5 } 64 Inch.
3 Sq. 42 F. 64 Inch.

CUBIC

CUBIC or SOLID MEASURE.

(69) 27 Yards.
9×3=27

243
3

729 Feet,
1728 Inches=1 Foot.

15552
3456
12096

1259712 Inches.

Inches.
(70) 1728)1259712(729 Feet.
12096

..5011
3456

15552
15552

.....

Feet.
27 { 3)729
9)243

27 Solid Yards.

T. F.
(71) 4 24
50

224 Feet.
1728

6912
3456
3456

387072 Inches.

Inches. *Feet.*
(72) 1728)387072(5,0|224
3456

.4147
3456

.6912
6912

....

4 T. 24 Ft.

END OF BOOK I.

THE
KEY
TO THE
TUTOR's GUIDE:
OR, THE
ARITHMETICIAN's REPOSITORY.

BOOK II. PART I.

NUMERATION.

(1) 1000000+500000=1500000 South Sea Bonds.
(2) 60000+12000+1300=73300 Lead.
(3) 15000000000+80000000=15080000000 Stivers.
(4) 120206070707 Rials of Plate.
(5) 3033030 Pieces of Eight.
(6) £.404000 34 14$\frac{5}{4}$=£.404001 15 3$\frac{1}{4}$

ADDITION.

INTEGERS.

(1)	(2)	(3)
140724	27460	867
296	176	317
42	2900	69
6740	274	1720
64167	1004	276842
20	64	49
2687	596	426074
2684	41	60
	6104	
217360		705998
	38619	

7. MONEY.

To add theſe Examples, I begin with the firſt, the Farthings, going up, ſaying 1 and 3 is 4, and 2 is 6, and 3 is 9, and 1 is 10 Farthings, that is 2½d. or 4 in 10 is 2 times and 2 over, which is $\frac{2}{4}$ or $\frac{1}{2}$ to put down under the Row of Farthings, and carry 2 Pence to the Unit's Place of Pence, ſaying 2 I carry and 1 is 3, and 6 is 9, and 1 is 10, and 9 is 19, and 6 is 25, and 4 is 29, and 1 is 30, then coming down the Place of Tens, ſaying, and 10 is 40, and 10 is 50, and 10 is 60, and 10 is 70 Pence, (which by the Pence Table are 5s. 10d.) or the 12's in 70 are 5 times and 10 over, which is 10 Pence to ſet down under the Row of Pence, and carry 5 Shillings to the Unit's Place of Shillings, ſaying 5 I carry and 8 is 13, and 2 is 15, and 4 is 19, and 7 is 26, and 1 is 27, and 6 is 33, and 7 is 40; I ſet down 0, and carry 4 to the Place of Tens, ſaying 4 I carry and 1 is 5, and 1 is 6, and 1 is 7, and 1 is 8, and 1 is 9,. Half of which (or the 2's in 9) is 4, and 1 over, which I ſet down under the Place of Tens, in the Row of Shillings, and carry the Half (viz. 4) to the (Unit's) Place of Pounds, and proceed then as in Integers.

But the common Method (though not ſo conciſe nor yet ſo eaſy) is to go up the Unit's Place, and come down the Tens, as in the Row of Pence, which (in this Example) comes to 90 Shillings, or the 20's in 90 are 4 times and 10 over, thus, 2,0)9,0(4l. 10s. ſo that it plainly appears to the Unit's Figure in the Diviſor, or, what I ſtop at is, 0, ſo that the Unit's Figure in the Dividend, or what the Unit's Row of Shillings comes to above 10, will be to ſet down, and to carry 1 for every 10 (as in Integers) to the Place of Tens, and what that Sum is, divide it by that Figure which is in the Place of Tens in the Diviſor, which in this Caſe is by 2, conſequently is the Reaſon of my halfing the Ten's Place of Shillings: Likewiſe when you ſtop at 40, 60, or &c. proceed as above, only, inſtead of dividing by 2, you muſt divide by 4, 6, or &c. obſerving always to ſet down what remains under the Place of Tens.—See Caſe 3. Sect. 5.

(1) £. 36 19 10½ (2) £. 227 18 9 (3) £. 472 11 3¼

	£.	s.	d.
(4)	270	16	6½
	60	0	10¼
	60	10	0¾
	96	6	10
	176	6	6½
	2	2	0
	16	17	6½
	100	0	0
	783	0	4½

	£.	s.	d.
(5)	260	17	0
	67	10	10¾
	170	10	0½
	100	10	6¼
	4	16	6½
	0	19	0¾
	37	11	11½
	600	10	0
	220	0	6½
	1463	6	6¾

	£.	s.	d.
(6)	276	17	0
	16	0	10¼
	269	11	11½
	107	19	0
	10	0	6
	0	14	11
	367	17	6¾
	0	12	4½
	20	10	6
	1000	0	0
	2070	4	8

WEIGHTS, MEASURES, &c.

Here I begin with the firſt Example, going up the Unit's Place in Grains, and find it comes up to 23, which, on a Slate or waſte Paper, I put down the 3, and carry 2 to the Place of Tens, and find it comes to 11, which I ſet down to the 3, and the Whole of the Row of Grains make 113, which I divide by as many Grains as make 1 Penny-weight, viz. 24, and find it will go 4 times and 17 over, thus, 24)113(4 times, and 17 remains; put down 17 Grains under the Row of Grains, and I carry 4 Penny-weights to the Row of Penny-weights, which I proceed with as in Shillings, as I ſtop at the ſame number, viz. 20: Likewiſe, wherever I ſtop at 4, 12, or any Number under, I proceed as in Farthings and Pence, according to what Number I ſtop at; but when I ſtop at any Number exceeding 12, as 16, 28, 54, &c. then I proceed as with the Grains above, ſo that it is impoſſible (without greatly perplexing the Learner) to perform theſe Examples before he has learned Diviſion: And I am very ſorry to ſee this Method not practiſed more than what it is, that ſo much of that precious Time of Youth ſhould be laviſhed with perplexing Methods of the Teachers, as it is as improper to teach a Scholar to add theſe Examples before he knows the primary Rules in Integers, as it is to teach a Child to read before he knows his Letters.

(1) oz. 170 dwt. 5 grs. 17 (2) lb. 114 4 0 9

(3)

(3) ℥ 62 5 1 1
(4) 86 lb. 9 0 0 8
(5) Tons 731 14 0 23
(6) lb. 121 11 11
(7) Yards 581 0 1
(8) Eng. E. 599 4 0
(9) E. Fl. 575 2 1
(10) Lea. 528 2 3 10
(11) Yards 976 0 4 0
(12) A. 668 0 6
(13) Tuns 67 0 1 25 0
(14) Pun. 155 62 2 1
(15) Tier 127 27 7
(16) An. 88 9 3
(17) A. hhds. 118 3 0
(18) B. hhds. 125 53 3
(19) A.B. 1241 0 7 6
(20) B. Fir. 125 4 0 0
(21) Qrs. 378 4 0 0
(22) Cha. 138 35 1
(23) La. 78 0 2 1 0
(24) Mo. 110 1 6 10
(25) D. 513 18 0 0

APPLICATION.

(1) D.
June 29
July 31
Aug. 31
Sept. 30
Oct. 31
Nov. 30
Dec. 31
Jan. 27

Answ. 240 Days.

(2)
Thus, 1772+60=1832 the Year required.

(3) £.
Youngest had 11000+1100+11=12111
Eldest 12111+1000=13111

Left to both 25222

(4) D.
Jan. 31
Feb. 29
Mar. 31
Apr. 30
May 31
June 30
July 31
Aug. 31
Sep. 30
Oct. 31
Nov. 30
Dec. 31

Anſ. 366 Days.

(5)	£.	s.	d.
Paid in Part	17	17	6
Rem. unpaid	82	2	6
Anſw.	100	0	0

(6)	£.	s.	d.
Private Men rec.	474	17	11½
Beſides which each Officer rec.	467	0	0
Anſw.	942	17	11½

(7)	£.	s.	d.
Corn Chandler,	123	19	0
Brewer, -	41	10	0
Butcher, -	212	0	0
Baker, - -	24	0	6
Tallow Chandler,	13	8	0
Taylor, -	137	9	9
Draper, -	74	13	6
Coach-maker,	214	16	6
Wine-merchant,	68	12	0
Confectioner,	16	2	0
Rent 82l.+82s.=	86	2	0
Servants Wages,	46	1	0
Ex. on the Road,	50	0	0
Anſw. £.	1108	14	3

(8)	£.	s.	d.
Oats, - -	46	7	6
Beans, -	100	0	0
Peaſe, -	16	16	0
Barley, -	73	0	8
Wheat, - -	56	9	10
Rye, - -	4	4	6
Water-carriage,	13	2	7
Charges -	1	13	0
Gains, -	18	18	0
Anſ. £.	330	12	1

(9)

(9)	*£.*	*s.*	*d.*
A paid -	13	2	6
B - -	2	13	0
C - -	0	14	4
D - -	1	9	8½
E -	11	0	6¼
F -	0	17	6
G - -	0	12	6
H -	1	10	6
I 27s.+13.	2	0	0
K 23+23+25s. +1s.=	3	12	0
L - -	9	3	4
M - -	12	12	0
N -	15	0	0
O 5×3+10s.=	1	5	0
Anſw. £.	76	2	10¾

(10)	*£.*	*s.*	*d*
To Merc. Wares,	418	2	6
Cheſhire Cheeſe,	52	18	0
Broad Cloth,	317	12	10
Lead, -	320	0	0
Bar Iron, -	173	0	3
Copper, -	1110	10	1
Accepted a Bill,	88	14	0
Do. on Honour,	50	0	0
Morocco Skins,	28	15	4
Conv. Inſur. &c.	43	0	0
Warehouſe Room, &c.	5	5	0
Factorage,	112	6	0
Anſw. £.	2720	4	0

(11)	*oz.*	*dwt.*
Fourteen Diſhes, wt.	193	6
Thirty-ſix Plates,	421	11
Four Doz. Spoons,	104	6
Six Salts, -	32	0
Knives and Forks,	83	9
Four Preſenters,	113	4
Mugs, Tumblers, Beakers, &c.	264	18
Tea-kettle & Lamp,	126	9
And the reſt of the Equipage,	93	2
Anſw.	1432	5

(12)		*Cwt.*	*qr.*	*lb.*
Bags	No. 1	2	2	10
	2	2	1	16
	3	2	0	24
	4	0	1	16
Pocket, 58½lb.=		0	2	2½
Ditto. -		0	2	2½
Anſw. wt.		8	2	15

(13)	*M.*	*f.*	*p.*
From hence to B,	39	6	0
thence to C,	46	0	24
- - D,	60	4	39
- - E,	37	6	0
From A to E is	184	1	23

(14)	*Years.*	*m.*	*d.*
	28	0	0
	2	10	16
	1	11	0
	3	7	25
	16	9	27
Anſw. Years	53	0	12

(15) Thus, 16+14=30 Years older.
(16) Thus, 17+29+23=69th Year, his Age required.

(17)

	Years.
When the Eldeſt was born the Father was	24
Then 19 Years and 19 Half Years=19+9½=	28½
The Youngeſt is now	21
Anſw. Father's Age,	73½

(18) 20 left

21	ſtolen the	3	Night.
42		2	
84		1	

A. 167 Sheep at firſt.

(9)

When Seth was born	Adam was	—	130 Years old.
Enos	Seth	—	105
Cainan	Enos	—	90
Mahaleel	Cainan	—	70
Jared	Mahaleel	—	65
Enoch	Jared	—	162
Mathuſelah	Enoch	—	65
Lamech	Mathuſelah	—	187
Noah	Lamech	—	182
And when the Flood happened	Noah was		600
		Anſw.	1656 Years.

8. SUBTRACTION.

INTEGERS.

	(1)	(2)	(3)
From	476004	276000	40106
Take	120706	106019	27109
Remains	355298	169981	12997

2. MONEY.

8. MONEY.

As the upper Figures in the firſt Example are all larger than thoſe which are underneath, ſo it is only taking the lower Line from the upper without borrowing at all; but in the ſecond Example I begin and ſay, 2 Farthings from 1 I cannot, but 2 Farthings from a Penny, or 4 Farthings, there remains 2, and 1 the top Farthing makes 3 Farthings, which I ſet down thus, $\frac{3}{4}$; then I carry 1 to 11 is 12 Pence, which from 10 Pence I cannot, but 12 from 12 there remains 0, but 10 the upper Figure is to put down, and carry 1 to 11 is 12, from 10 I cannot, but 12 from 20 there remains 8, and the top Figure 10 is 18 Shillings to put down, and carry one to the Unit's Place of Pounds, which proceed with as in Integers.

Note, When the Learner is pretty ready at ſubtracting, he need not make uſe of the Words *I cannot*, as it is always ſeen at Sight whether he can or cannot; ſo that when he ſees the lower Figure is greater than that which ſtands over it, always take the lower Figure from what you borrow, and to the remainder add the top Figure, and their Sum ſet down; thus, in the 2d Example, I ſay 2 from 4, 2 and 1 is $\frac{3}{4}$ to ſet down, and carry 1 to 11 is 12, from 12 0, but 10 to ſet down, and carry 1 to 11 is 12, from 20, 8, and 10 is 18 to ſet down and carry 1, &c.

	£	s.	d.		£.	s.	d.		£.	s.	d.
(1)	21	13	$5\frac{1}{4}$	(2)	33	18	$10\frac{3}{4}$	(3)	87	7	$5\frac{1}{2}$
(4)	77	14	$5\frac{3}{4}$	(5)	10	9	$11\frac{3}{4}$	(6)	103	12	$11\frac{1}{4}$

(7)	£.	s.	d.
Paid	370	17	1
Rem. unpaid	105	2	11

(8)	£.	s.	d.
Received	1450	4	9
Rem. unpaid	26	9	9

(9)	£.	s.	d.
Borrowed	2648	19	$10\frac{1}{4}$
Paid	1843	14	3
Bal.	805	5	$7\frac{1}{4}$

WEIGHTS, MEASURES, &c.

(1) lb. 2 10 17 20 (2) oz. 3 13 7 (3) lb. 3 0 5 0 14

(4) T. 1 19 3 21 (5) lb. 2 11 15 (6) Yds. 66 3 1

(7) E. Eng. 2 4 3 (8) E. Fl. 58 0 1 (9) Lea. 39 1 4 27

(10) Yds. 50 2 11 (11) A. 67 1 16 (12) T. 1 0 0 48 1

(13) Pun. 3 75 3 0 (14) Tier. 3 40 5 (15) An. 6 6 5

(16) A. hhds 6 41 3 (17) B. hd. 1 48 5 (18) B. fir. 3 4 6

(19) A. Bar. 27 2 5 0 0 (20) Qrs. 4 4 3 (21) Cha. 6 25 2

(22) La. 4 0 4 4 3 (23) Mo. 2 3 4 23

(24) D. 156 16 42 45

APPLICATION.

(1) Thus, 1789—1735=54 Years old.

(2) First, 102—72=30 Diff. and 102+72=174 Sum.

(3)	£.	s.	d.
A's Sum	74	17	0
Diff.	49	13	6
Answ. B's Sum £.	25	3	6

(4)	£.	s.	d.
Borrowed	100	0	0
Paid	41	17	6
Anſ. Rem. £.	58	2	6

(5)	£.	s.	d.
Income —	600	0	0
King's Tax, —	140	0	0
Repairs, —	94	17	6
Pays in all, —	234	17	6
Anſw. Neat Income,	365	2	6

(6)	£.	s.	d.
Left to both, - -	13111	10	6
Daughter, 11000+1100+11=	12111	0	0
Anſw. the Son had £.	1000	10	6

(7)	£.	s.	d.
Value of both, - -	35	10	0
Ditto Horſe, - -	12	12	0
Ditto Furniture, - -	22	18	0
Anſ. Difference, £.	10	6	0

(8)

Dr.	£.	s.	d.	Cr.	£.	s.	d.
To A, -	71	12	6	By Caſh, -	3	13	6
B, -	34	9	9	Commodities,	23	10	0
C, -	16	8	8	Houſh. Furnit.	13	8	6
D, -	44	0	0	Plate, -	7	18	5
E, -	66	7	6	Tenement,	56	15	0
F, - -	11	2	3	Book Debts,	87	13	10
G, -	19	19	0				
H, 13s. 4d.×30=	20	0	0	Cr. £.	192	19	3

	£.	s.	d.
Dr.	283	19	8
Cr.	192	19	3
Anſ. Bal. loſt £.	91	0	5

(9)	£.	s.	d.
Firſt Bond,	114	10	0
Intereſt, -	19	0	0
Amount, £.	133	10	0
Paid off, -	42	0	0
Second Bond,	91	10	0
Intereſt, -	13	4	8
Amt. £.	104	14	8
Paid off, -	37	14	2
Third Bond,	67	0	6
Intereſt, -	9	11	3
Anſw. Amt. £.	76	11	9

(10)	£.	s.	d.
Altog. are worth	50	0	0
Horſe and Harneſs	38	16	6
Chaiſe, £.	11	3	6
Chaiſe & Harneſs	13	13	0
Chaiſe, -	11	3	6
Harneſs, £.	2	9	6
Horſe & Harneſs	38	16	6
Harneſs,	2	9	6
Horſe, £.	36	7	0

(11)

(11)

	C.	qrs.	lb.	
Groſs	12	0	19	
Tare	1	3	26	
Net	10	0	21	first Venture.
	7	0	15	ſecond Venture.
Anſw.	C. 3	0	6	Difference.

	C.	qrs.	lb.
Groſs	8	2	2
Tare	1	1	15
Net	7	0	15

(12) A.

Dr.					Per Contra,		Cr.		
1784.		£.	s.	d.	1784.		£.	s.	d.
Jan. 21,	To Caſh,	9	10	0	Jan. 11,	By Caſh,	17	17	0
Feb. 29,	Ditto	5	6	8	Feb. 24,	Ditto	42	0	0
Mar. 17,	Ditto,	12	2	6	Mar. 24,	Ditto	11	18	4
19,		5	5	6					
						Cr.	71	15	4
	£.	32	4	2		Dr.	32	4	2
						Bal. to A. £	39	11	2

B.

Dr.					Per Contra,		Cr.		
1784.		£.	s.	d.	1784.		£.	s.	d.
Jan. 24,	To Caſh,	6	10	0	Jan. 11,	by Caſh,	34	11	6
Mar. 2,	Ditto,	6	6	0	Feb. 12,	Ditto,	16	14	0
19,	Ditto,	5	5	0	Mar. 14,	Ditto,	17	8	8
					24,	Ditto,	11	18	4
	£.	18	1	0					
						Cr.	80	12	6
						Dr.	18	1	0
						Bal. to B, £.	62	11	6

C.	Dr.			Per Contra,	Cr.		
1784.	£.	s.	d.	1784.	£.	s.	d.
Jan. 30, To Caſh,	19	8	4	Jan. 11, By Caſh,	28	18	10
Mar. 19, Ditto,	5	5	0	21, Ditto,	12	5	0
				Mar. 2, Ditto,	21	0	0
	£. 24	13	4	24, Ditto,	11	18	4
To A. -	39	11	2	Cr.	74	2	2
B. -	62	81	6	Dr.	24	13	4
C. -	49	8	10				
				Bal. to C. £	49	8	10
Jointly,	£. 151	11	6				

(13) Stock,	Dr.			Per Contra.	Cr.		
	£.	s.	d.		£.	s.	d.
To D. E. -	713	13	0	By Brandy,	874	10	6
M. F. -	352	10	8	Claret,	754	4	0
L. P. -	180	12	0	Corn,	675	17	3
I. B. -	57	12	10	Canary Seed,	113	0	0
Inſurance,	190	0	0	Indigo,	632	12	0
				Saffron,	253	5	0
	£. 1494	8	6	W. P.	384	10	0
				Wines p. F. G.	1011	10	0
				Pepper p. S. Q.	1252	16	8
				Bond on R. O.	300	0	0
				Note on T. M.	260	14	0
				India Bonds,	459	0	0
				Intereſt,	25	14	6
				Bank Stock,	2134	4	6
				Banker,	1892	17	6
				Cr.	11024	15	11
				Dr.	1494	8	6
				An. Preſ. Worth	9530	7	5

(14)

Stock,	Dr. £.	s.	d.	Per Contra	Cr. £.	s.	d.
To Debts, &c.	280	0	0	By Caſh, &c.	11505	10	0
				By Trade he cleared.	393	13	1
				Cr.	11899	3	1
				Dr.	280	0	0
				Anſw. Bal. £.	11619	3	1

(15)

Factor,	Dr. £.	s.	d.	Per Contra,	Cr. £.	s.	d.
To Tin,	197	12	0	By Wines,	226	16	6
Bees-wax,	71	7	6	Figs,	150	11	3
Stockings,	47	3	6	Fruit,	104	6	0
Tobacco,	943	15	10	Olives,	136	10	0
Cotton,	123	3	7	Oil,	193	17	0
Wheat	116	5	6	Raiſins,	143	0	4
				Wool,	75	13	8
Dr. £.	1499	7	11	Commiſſion,	71	18	11
Cr.	1102	13	8	£.	1102	13	8
Employer draws for £.	396	14	3				

(16)

	Y.	m.	w.	d.	h.	m.
He was to ſerve - - -	14	0	0	0	0	0
Of which he accompliſhed Y. m. w. d. h. m. 11 11 11 11 11 11—	12	1	0	4	11	11
Anſwer, to ſerve, Years	1	11	3	2	12	49

(17)

(17)	W.	Dr.				Per Contra,	Cr.		
1784.		£.	s.	d.	1784.		£.	s.	d.
June 30,	To Caſh,	66	3	0	June 4,	By Caſh,	47	18	2
July 5,	Ditto,	15	10	9		Note,	200	0	0
12,	Ditto,	10	10	0	24,	Ditto,	14	12	10
					July 15,	Ditto,	52	0	0
		£. 92	3	9		Cr.	314	11	0
						Dr.	92	3	9
						B. due to W. £.	222	7	3

	X.	Dr.				Per Contra,	Cr.		
1784.					1784.				
June 24,	To Caſh,	47	10	8	June 4,	By Bill,	33	14	9
July 7,	Ditto,	7	3	1		Caſh,	66	5	3
19,	Ditto,	38	18	10	July 24,	Ditto,	19	19	0
		£. 93	12	7		Cr.	119	19	0
						Dr.	93	12	7
						Bal. due to X. £.	26	6	5

	Y.	Dr.				Per Contra,	Cr.		
1784.					1784.				
June 16,	To Caſh,	43	12	6	June 4,	By Bal.	116	14	10
30,	Ditto,	88	13	4	14,	Ditto,	120	0	0
July 12,	Ditto,	81	19	8	28,	Ditto,	18	5	0
					July 15,	Ditto,	42	0	0
		£. 214	5	6			296	19	10
							214	5	6
						Bal. due to Y. £.	82	14	4

	Z.	Dr.				Per Contra,	Cr.		
1784.					1784.				
June 20,	To Caſh,	11	11	0	June 4,	By Caſh,	70	8	0
July 7,	Ditto,	12	8	3	July 15,	Ditto,	31	12	4
						Aſſignment,	63	4	8
		£. 23	19	3		Cr.	165	5	0
						Dr.	23	19	3
						Bal. due to Z. £.	141	5	0

		£.	s.	d.
To W.	—	222	7	3
X.	—	26	6	5
Y.	—	82	14	4
Z.	—	141	5	9
Jointly, £.		472	13	9

		Feet.
(18) Had at firſt,	— — —	127
Let off, 57+42	— —	99
Anſwer, remains	— —	28

(19) Thus, 42—14=28 the Difference required.

(20) Now 134—93=41 Son's Age,
And 112—41=71 Father's.

(21) Firſt, 25—14=11 Diff. of their Ages.
Then 25+11=36 C.'s Age.

(22) Now, 1789+13=A. D. 1802, B. born.
Then, 1802—1693=109 Years, A. older than B.

		lb.
(23) In fair Weather,	—	33905
— foul,	— —	30624
	Anſwer,	3281

(24)	*Years.*		*Years.*		*Years.*
Before Chriſt	200		50		1784
Since -	+1784		+1784		—140
Hip. and Arch. flouriſhed	1984	Paſſidonius	1834	and Ptolemy	1644 Y.

(25)	*lb.*		*lb.*
Pekin Bell weighs	120000	Nankin Bell, -	50000
From which take	94600	Erford Bell, -	25400
Rem. Erford Bell,	25400	Anſwer, Difference	24600

(26)	*Years.*		*Years.*
Grandfather's Age,	119	Father's Age is	65
From which take	83	From which take	36
Leaves your Age	36	Anſwer, Difference	29

(27)	*Feet.*	
Goes up the firſt Day,	8	
Comes down at Night,	4	
	4	Feet made good the firſt Day.
Goes up the ſecond Day,	8	
	12	
Comes down at Night,	4	
	8	made good the ſecond Day.
Goes up the third Day,	8	
	16	
Comes down at Night,	4	
	12	made good the third Day.
Goes up the fourth Day,	8	
	20	the fourth Day at Night, Anſ.

(28) Firſt, 1784—1747=37.

$$\left.\begin{array}{l}\text{then } 37+24=61 \text{ C.'s}\\ \text{and } 61+17=78 \text{ A.'s}\\ \text{alſo } 78+13=91 \text{ B.'s}\end{array}\right\}\text{ Age.}$$

(29) Conqueſt, - - Anno 1066
To which add 134+10= 144

Edifice finiſhed, Anno 1210

The Peace of Utrecht, Anno 1713
From which deduct - 70

Demolition, - Anno 1643
From which deduct - 1210

Anſwer, Duration, - 433 Years.

(30)

	Years.		*Years.*
Revolution,	Anno 1688	Forfeited in Anno	1551
Forfeited before,	137	Granted -	1239
Forfeited in	Anno 1551	Anſwer ſubſiſted	312

(31)

Moſes born Anno	2433	Chriſt born Anno	4000
To which add	832	From which take	312
Homer born Anno	3265	Cæſar born Anno	3960
		From which take	312
		Alexander born Anno	3648

$$\text{Then }\left.\begin{array}{r}3960\\4000\\3648\end{array}\right\}-3265=\left\{\begin{array}{l}695 \text{ from Homer to Cæſar.}\\735 \text{ ——————— Chriſt.}\\383 \text{ ——————— Alexander.}\end{array}\right.$$

Anſwer, 1813 Years, Sum of the Intervals.

(32) Fig. 1.

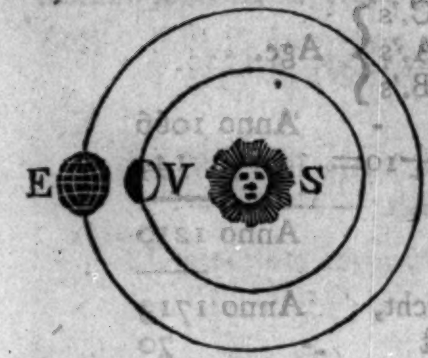
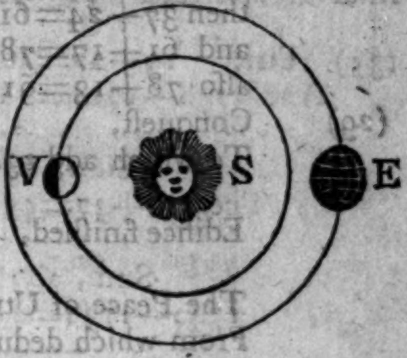


Fig. 2.



Suppoſe S. the Sun; V. Venus; and E. the Earth: then Fig. 1. will repreſent them when in Perigæo; and Fig. 2, when they are in Apogæo.

∵ 81000000—59000000=22000000=S E—S V=E V Fig. 1, or the Diſtance the Earth is from Venus, when in Perigæo.

And 81000000+59000000=140000000=V S+S E=V E. Fig. 2. or the Diſtance the Earth is from Venus, when in Apogæo.

Therefore 140000000—22000000=118000000 Miles the Anſwer.

(33)
First 23+ 8=31 A.'s }
And 31+19=50 B.'s } Age.
Alſo 50—14=36 C.'s }
Now 31+50=+36=117 the Sum.
Then 117—22=95 D.'s Age.

(34)

When Selah was born Arphaxad was — 35 Years old.
—— Eber — Selah ——— 30 ———
—— Peleg — Seber ——— 34 ———
Eber lived after the Birth of Peleg — 430 Years.

From the Birth of Arphaxad to the Death of Eber was ——— } 529
Shem died after the Birth of Arphaxad, 500

Eber was the Survivor by ——— 29 Years.

Then per Queſt. 2+500+29+194=725 Years, the whole Interval, and 1000—725=275 Years the Interval wanted.

(35) Firſt 19+27=46 K.'s Age in 1720.
And 1738—1720=18

Sum, 64 K.'s Age in 1738.
Then 18+27=45 L.'s

Sum, 109
1740—1738=2

Sum, 111—24=87 Years the Age of M. in 1740.

(36) Firſt 318+207=525 B.
Then 525—104=421 C.
And 421— 84=337 D.
Then 337+112=449 E.
Alſo 449+ 47=496 F.
} Flouriſhed.

(37) Sam was born before Toby 28 Years.
Toby died at - - 12 —— old.
After which Sam lived 19

Sam's Age, - - 59 Years.
From which deduct 16+11=27

Leaves Rachel's Age 32 Years.
To which add 7+4=11

Gives Joſhua's Age - 43 Years.
Then 12+59+32+43=146, the Sum of their Age.

(38)

			Years.
B. born A. D.	1108	Z. born A. D.	1527
Lived before C.	48	After which Y. was born	74
C. born	1156	Y. born Anno	1601
Lived before D.	113	Before which X. was bo.	114
D. born Anno	1269	X. born Anno	1487

(39)

(39) I ſhall be $34+17=51$ Years of Age.
And you will be $70-34=36$

(40)	The Reformation, Anno	1517
	From which deduct -	215
	Invention of the Compaſs, Anno	1302
	To which add -	42
	Gunpowder invented, Anno	1344
	To which add -	148
	America diſcovered, Anno	1492
	The Reformation, -	1517
	From which deduct -	77
	Printing invented, Anno	1440
(41)	Reſtoration, Anno -	1660
	Grant made before -	33
	Firſt Grant made, Anno	1627
	Duration, - -	210
	Firſt Grant ended, Anno	1837
	Reverſionary Grant's Continuance,	99
	Its Expiration, Anno -	1936

(42) When B. is 41 A. will be $41-18=23$ Years old.
But when A. is 72, B. will be $72+18=90$ Years old.

(43)

Temple built, Anno	3000	Chriſt born A. D.	4000
Troy before	443	Rome built before,	744
Troy built, Anno	2557	——— A.D.	3256
London after,	260	Carthage built before,	113
London built, Anno	2817	——— A. D.	3143
		London built,	2817
		London older than Carthage by	326

(44)

Suppoſe E the Earth, M the Moon, and S the Sun; then the Eclipſe of the Sun will be repreſented by Fig. 3, and that of the Moon by Fig. 4.

Therefore 81000000—240000=80760000=S M Fig 3, or the Diſtance theſe two Luminaries are aſunder, in an Eclipſe of the Sun.

Likewiſe 81000000+240000=81240000=S M Fig. 4, or the Diſtance theſe two Luminaries are aſunder, in an Eclipſe of the Moon.

Fig. 3.

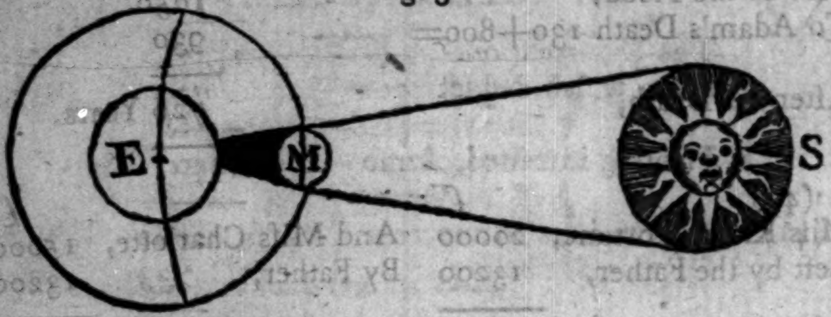
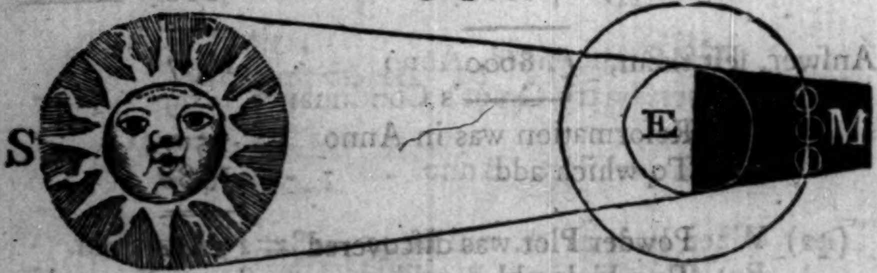


Fig. 4.



(45)	From the Creation to the Flood	Years
	(per Q. 19. P. 32.) -	1656
	thence to the Buiding of Solomon's Temple	1336
	to Mahomet, - -	1630
	Together - -	4622
	Mahomet after Chriſt, - -	622
	Anſwer, Chriſt born, A. D.	4000

(46)

When	Seth was born	Adam was	—	130 Years old.
	Enos	Seth	—	105
	Canaan	Enos	—	90
	Mahaleel	Canaan	—	70
	Jared	Mahaleel	—	65
	Enoch	Jared	—	162
	Methuſelah	Enoch	—	65
	Lamech	Mathuſelah	—	187
	Noah	Lamech	—	182

When the Flood happened Noah was 600 Years.

Year of the Flood, - - 1656
To Adam's Death 130+800= - 930

After his Death, - - 726 Years.

(47) £. £.
Miſs Kitty's Fortune, 20000 And Miſs Charlotte, 15000
Left by the Father, 13200 By Father, 13200

Left by the Grandmo. 6800 By Grandmother, £. 1800
+1800

Anſwer, left them, £. 8600

(48) Reformation was in Anno 1517
To which add - - 88

Powder Plot was diſcovered 1605
To which add - - 43

King Charles murdered, Anno 1648
Then 1714—54=1660 King Charles the II. returned.
And 1660—1648=12 Years, the Anſwer.

(49) Firſt 180— 47=133 Years ſince B. died.
And 161—133= 28 Years, B.'s Age.
Then 47+ 43= 90——— C.'s Age.

Sum, 118———the Anſwer.

(50) A. D.
Firſt, 1789+28=1817 Ja. will be 50.
And, 1817—50=1767 Jacob.
Alſo, 1767—26=1741 Timothy.
Likewiſe, 1741—17=1724 Sampſon.

(51) Firſt, 1733— 445=1288 A. born.
Then, 1362—1288= 74 A.'s
And, 37+ 18= 55 B.'s } Age.
Alſo, 256— 197= 59 C.'s
Again, 1733— 75=1658 D. died.
Then, 1658—1578= 80 D.'s Age.

(52) Reformation, Anno - 1517
From which deduct - 23

A. died Anno - - 1494
born - - 1441

53 A.'s Age.

Then 1517+49=Anno 1566 B. died.
And 1494— 7=— - 1487 B. born.

79 B.'s
Alſo, 36—7+9= 20 C.'s } A.
Then, 53+79+20=152, the Anſwer.

(53) Anno A. D.
A. born 1438, lived 48 Years; then 1438+48=1486 died.
B. died 1502, bo. bef. 77 Yrs —— 1502—77=1425 born.
C. in 1577, was 22 Yrs. old, —— 1577—22=1535 ——.
And in 1577+54=1631 died.
D. died 1648, and in 1616 had lived ½ his Time; then
1648—1616=32 Half his Age double of which is 64
Then 1684, born bef. 64 Yrs. then 1648—64=1584 born.
E. in 1648 was 13 Yrs. old, —— 1648—13=1635 born.
And in 1635+13+14+31+7=1700 died.
F. in 1635 born after 27 Yrs. then 1635+27=1662 born.
G. in 1662 ———— 31 ———— 1662+31=1693 ——

(54) Anno	Anno		
1727—42=1685	A. died	}	Aged 47 Years.
1685—47=1638	— born		
1638+13=1651	B. born	}	Aged 53 ——
1712— 8=1704	— died		
1638—17=1621	C. born	}	Aged 91 ——
———————1712	— died		
1621—23=1598	D. born	}	Aged 64 ——
1598+64=1662	— died		
1704+11=1715	E. born	}	Aged 30 ——
1733+12=1745	— died		
1638—1598=40	Half of which is 20.		
1638—20=1618	F. born	}	Aged 113 Years.
1745—14=1731	— died		

The Sum of all their Ages is 398 Years.
Then 113—91=22 Years F. ſurvivor.

MULTIPLICATION.

INTEGERS.

(1) 14276084	(2) 20749509	(3) 1204674
4	9	12
Prod. 57104336	186745581	14456088
(4) 4074746	(5) 147624	(6) 42768
16	69	748
Prod. 65195936	10186056	31990464
(7) 10646	(8) 14276	(9) 3142708
5278	39674	467852
Prod. 56189588	566386024	1470322223216

(10) 27680709
40700609
Prod. 1126621713851781

(11) 2142760
4100
8785316000

(12) 21700
954000
20701800000

(13) Mul. 46904
By 9×3=27
Prod. 1266408

(14) Mul. 10709
By 8×7×6=336
3598224

The above Examples are performed as in Sect. 4.

CONTRACTIONS.

EXAMPLES.

(1) Thus, 476270000
47627
Prod. 476222373

(2) Thus, 2746400000
27464
9)2746372536
Prod. 305152504

(3) 46740000
4674
9)46735326
5192814
2
Prod. 10385628

(4) 476940000
47694
9)476892306
52988034
7
Prod. 370916238

(5)
747600000
7476
3)747525240
Prod. 249175080

(6) Thus, 427630000
42763
3)427587237
142529079
2
Prod. 285058158

(7)
4276
126
25656
51312=6×2=12
538776

(8) Mul. 6946
486
41676
333408=6×8
Prcd. 3375756

9. COMPOUND MULTIPLICATION.

MONEY.

(1)	£.	s.	d.
Mul.	14	17	11
By			2
Prod.	29	15	10

(2)	£.	s.	d.
	140	10	0½
			6
	843	0	3

(3)	£.	s.	d.
	17	6	4
			9
	155	17	0

(4)	£.	s.	d.
		17	6½
			4
£.	3	10	2

(5)	£.	s.	d.
	3	0	6
			5
£.	15	2	6

(6)	£.	s.	d.
		7	10
			7
£.	2	14	10

(7)	£.	s.	d.
		18	9½
			8
£.	7	10	4

(8) *s.* *d.*
12 8
9
£. 5 14 0

(9) £. *s.* *d.*
2 6 4
10
£. 23 3 4

(10) *s.* *d.*
12 7
11
£. 6 18 5

(11) £. *s.* *d.*
1 17 6¾
12
£. 22 10 9

(12) *s.* *d.*
6 7¾
7×2=14
£. 4 13 0½

(13) *s.* *d.*
10¼
6×3=18
£. 0 15 4½

(14) £. *s.* *d.*
2 9 6
9×3=27
£. 66 16 6

(15) *s.* *d.*
4 11½
6×5=30
£. 7 8 9

(16) *s.* *d.*
10 8
6×6=36
£. 19 4 0

(17) *d.*
2½
9×5=45
£. 0 9 4½

(18) £. *s.* *d.*
1 7 0
10×5=50
£. 67 10 0

(19) *s.* *d.*
2 7½
8×7=56
£. 7 7 0

(20) £. *s.* *d.*
1 11 0
8×8=64
£. 99 4 0

(21) s. 15 d. 9
9×8=72

£. 56 14 0

(22) d. 11¾
10×8=80

£. 3 18 4

(23) s. 9
12×7=84

£. 37 16=84×9

(24) s. 1 d. 10¼
12×8=96

£. 9 2.0

(25) s. 18 d. 11½
11×9=99

£. 93 16 10½

(26) s. 11 d. 10
10×10=100

£. 59 3 4

(27) s. 1 d. 6
12×10=120

£. 9 0 0

(28) s. 1 d. 10
12×11=132

£. 12 2 0

(29) s. 1 d. 7¾
12×12=144

£. 11 17 0

(30) £. 1 s. 4 d. 10½
4×4+1=17

£. 21 2 10½

(31) s. 19 d. 11¾
6×3+1=19

£. 18 19 7¼

(32) s. 1 d. 7½
7×4+1=29

£. 2 7 1½

£. s. d.
(33) 2 17 6
$6\times6+2=38$
£. 109 5 0

s. d.
(34) 5 10
$9\times5+2=47$
£. 13 14 2

s. d.
(35) 10 $4\frac{1}{2}$
$8\times7+2=58$
£. 30 1 9

£. s.
(36) 5 17
$8\times8+3=67$
£. 391 19

s. d.
(37) 6 $4\frac{1}{2}$
$9\times8+3=75$
£. 23 18 $1\frac{1}{2}$

s. d.
(38) 19 $1\frac{1}{4}$
$9\times9+5=86$
£. 82 6 $6\frac{1}{2}$

s. d.
(39) 3 6
$10\times10+6=106$
£. 18 11

(40)
£. s. d.
3 0 6
$7\times5+\frac{1}{2}=35\frac{1}{2}$
£. 107 7 9

(41)
£. s. d.
1 12 10
$9\times8+4\frac{1}{2}+\frac{1}{4}=76\frac{3}{4}$
£. 125 19 $11\frac{1}{2}$

(42)
£. s. d.
1 16 $6\frac{1}{2}$
$4\times4+1+\frac{1}{4}=17\frac{1}{4}$
£. 31 10 4

(43)
£. s. d.
4 6 7
$8+\frac{1}{2}=8\frac{1}{2}$
£. 36 15 $11\frac{1}{2}$

(44)

(44)

£.	s.	d.
26	17	6

10×10+½=100½

£.	s.	d.
£. 2700	18	9

(45)

s.	d.
1	10¾

7×4×4=112

£.	s.	d.
£. 10	12	4

(46)

s.	d.
2	5

8×7×6=336

£.	s.	d.
£. 40	12	0

(47)

d.
11¾

10×7×5=350

£.	s.	d.
£. 17	2	8½

WEIGHTS, MEASURES, &c.

Proceed here in the like Manner with the Product of each Denomination, as you did with the Sum of each Denomination in Addition.

(1)

lb.	*oz.*	*dwts.*	*grs.*
14	10	0	21
			4
59	4	3	12

(2)

T.	*C.*	*qrs.*	*lb.*
17	17	0	24
			2
35	14	1	20

(3)

C.	*qrs.*	*lb.*	*oz.*	*drs.*
14	0	21	0	14
				7
99	1	7	6	2

(4)

lb.	℥.	ʒ.	℈	*grs.*
10	6	4	1	17
				9
94	11	1	1	13

(5)

Yds.	*qrs.*	*na.*
127	0	3
		12
1526	1	0

(6)

E.E.	*qr.*	*na.*
40	4	2
		11
449	4	2

(7)

Lea.	*m.*	*fur.*	*p.*
120	0	7	24
			5
601	1	6	0

(8)

	Yds.	*f.*	*in.*	*b.c.*
(8)	147	2	11	2
				6
	887	2	10	0

	W.hds.	*ga.*	*pts.*
(9)	46	47	7
			3
	140	17	5

	Tu.	*p.*	*hds.*	*g.*	*qt.*
(10)	6	1	1	46	3
					8
	55	0	1	59	0

	Tier.	*g.*	*qts.*
(11)	27	41	2
			6
	167	39	0

	B.hds.	*g.*	*pts.*
(12)	4	47	6
			5
	43	51	6

	A.hds.	*gal.*	*q.*	*p.*
(13)	10	17	3	1
				4
	41	23	2	0

	B.	*b.*	*fi.*	*g.*	*p.*
(14)	12	2	7	7	
				6	
	76	1	2	2	

	A.	*r.*	*p.*
(15)	140	2	26
			5
	703	1	10

	La.	*gr.*	*bu.*	*p.*
(16)	74	7	4	1
				7
	523	2	5	3

	D.	*h.*	*m.*	*ſec.*
(17)	365	5	48	57
				12
	4382	21	47	24

APPLICATION.

(1) Now, $54\times54=2916$.
And $46\times19=874$.
Then 29 6—874=2042, the Number required.
For 2916—2042=874 Proof.

(2) Thus, $142\times50=7100$*l.* the Sum required.

(3) Now, $12\times12\times6=864$=Six Dozen Dozen.
And $12\times6=$ 72 Half a Dozen Dozen.

Anſwer, { 792 Difference.
936 Sum.

(4)

(4)
52 Counties.
7×6=42
364
6
2184 Pariſhes.
246
13104
52416=6×4=24
537264 Houſes.
10
5372640 Perſons.

(5)
Firſt 28×2 =56
And 8×2+20=36
Anſw. Difference 20
Again 55×2= 110
And 5×2+50= 60
Anſw. Difference 50

(6)	*Years.*		£.		£.
The firſt	4	he cleared	364	per Ann.	=364×4=1456
The next	3	——	586		=586×3=1758
And the laſt	3	——	873		=873×3=2619
				His whole Gain, £.	5833

Then 13000—5833=7167 £. his original Stock.

To find the State of his Fortune at each Year's End, thus: He began with 7167 £. cleared the firſt Year 364 £. which, added to 7167£.=7531£. his Worth at the firſt Year's End; then 7531+364=7895£. at the ſecond Year's End; and in this Manner proceed by a continual adding the preceding Year's Gain.

(7)	£.	s.	d.
Each Pariſh paid	37	16	4
Hamlets	28	3	10
Townſhips	19	19	0
Sum	85	19	8
		×	4
£.	343	16	8 paid in all.

	£.	s.	d.	
then	373	14	8	aſſeſſed.
	343	16	8	paid.
Anſ. £.	29	18	0	the Defic.

(8)

C. qrs.	C.	qrs.	lb.	
	137	2	10	Gr. Wt.
$13\ 1 \times 3 =$	39	3	0	Tare.
Anſw. C.	97	3	10	Net Weight.

(9)

		£.	s.
To the Widow,	- -	1780	0
——— Children,	$\overline{1250} \times 4 =$	5000	0
——— Relations,	31*l.* 10*s.* $\times \overline{5 \times 3}(15) =$	472	10
——— Charity,	- -	150	0
£.	Died worth	7402	10
Gained by Trade,	$126 \times \overline{5 \times 5 + \tfrac{1}{2}}(25\tfrac{1}{2}) =$	3213	0
	Anſwer, begun with £.	4189	10

(10)

		£.	s.	d.
Income,	- - -	500	0	0
Expends,	19*s.* $\overline{11d. \times 9 \times 8 \times 5 + 5}(365) =$	363	9	7
	Anſwer, lays up	136	10	5

(11)

		£.	s.	d.
Expends,	£. $\overline{1l.\ 12s.\ 6d. \times 9 \times 8 \times 5 + 5}(365)$	593	2	6
Lays up,	- - -	294	12	6
	Anſwer, Income	887	15	0

(12) Firſt, $20 + 423 + 19 = 462$ the Diviſor.

Then $\overline{423 + 462} + 20 = 195446$, the Dividend.

(13)

(13)	£.	s.	d.	
Rent	7	7	6	per Quar.
Repair	0	18	6	———
Tax	0	8	9	———
Sum	8	14	9	———
			4	
An. £.	34	19	0	per Ann.

(14)		£.	s.	d.
Widow,	- -	5000	0	0
Charity,	£.	846	10	0
Nephew,	1230×3=	3690	0	0
Nieces,	1050×4=	4200	0	0
Houſe-keepers,	5*l.* 5*s.* ×5×4(20)=	105	0	0
Executor,	200 Guin. =	210	0	0
	Anſwer, died worth, £.	14051	10	0

(15)	£.	s.	d.
	100	0	0
	1	7	0
	0	10	6
In each Diviſion was	101	17	6
		×	6
In each drawer was	611	5	0
		×	12
Anſwer, £.	7335	0	0

(16) *Yards.*
73726 at one Circumvolution.
3
221178 in a Minute.
60
13270680 in an Hour.
10
132706800 in a Day.
365—63= 302 Days worked.
2654136
3981204
Anſwer, 40077453600 Yards.

(17) Firſt 20× 60=1200 Feet, Piers ſtand on.
And 21×170=3570 —— Arches Span.

Width of the Danube, 4770
—— Thames, 1200

Anſwer, 3570 Feet the Difference.

(18)
Now 187 is the leſſer Number.
And 187+34=221 the greater.
Then 221×187=41327 their Product.
Alſo, 41327×41327=1707920929 Square of Ditto
Likewiſe, 187+221=408 their Sum.
And 408×408=166464 Square of Ditto.
Alſo, 34×34=1156 Ditto of their Difference.
And, laſtly, 1707920929+166464+1156=1708088549 the Sum of thoſe Squares.

(19) Firſt $109\times73=7957$ the greater Number.
And $28\times17=\ \ 476$ Difference.

7481 leſſer Number.

Then $7957+7481=15438$ their Sum.
And $7957\times7481=59526317$ their Product.

(20)

	Acres.
A. had	757
B.	2104
C.	16410
D.	12881
E.	11008
F.	9813
H.	13800
I.	8818
Wanted,	416

Sum, $76007=\frac{1}{5}$ of the Whole.
5

Anſwer, 380035 Acres.

(21)

One comes up	6 Ways.
	6
Two comes up	36
	6
Three comes up	216
	6
Four comes up	1296 the Anſ.

(22)

	£.	s.	d.
100 *G.*=	105	0	0
Ten Marks=	6	13	4

	£.	s.	d.		£.	s.	d.
W. had	98	6	8	-	98	6	8
	—0	16	8				
R.	97	10	0	-	97	10	0
	—6	0	0				
T.	91	4	0	-	91	4	0
	+3	17	2				
S.	95	1	2	-	95	1	2
				Anſwer,	£. 382	1	10

D I V I S I O N.

INTEGERS.

(1) 4)14076893

3519223—1

(2) 12)30742165

2561847—1

(3) 89)2410296(27081 87/89

Quot. Rem.

(4) 576)98420649(170869—105

(5) 3029)308763705(101935—2590

(6) 46058)16221212499(352190—45479

(7) 127345)51799555(406—97485

(8) 3090807)78855994985(25513—235994

(9) 37,00)12764214,27(344978—2827

(10) 827,000)4074964,478(4927—335478

(11) 93,00)247698514,00(2663424 82/93

(12) 14 {2, 7} 67402

33701

4814—6

(13) 63 {7, 9} 701747

100249—4

11138—7 } 53

(14) 112 {4, 4, 7} 4170642

1042660—2

260665

37237—98

(15) 336 {6, 7, 8} 2741724

456954

65279—1

8159—300

E X A M P L E S.

(16) 1,000(467|7823

4|677

|4

4681|1504

Then 1504 the Sum of the Overpluſſes, divided by 999 the Diviſor gives 1, and 505 remains.

So $4681+1\frac{505}{999}$,=the Quotient required.

(17) Firſt, 2692464

$\times 9$

2423 | 2176

| 2423

2423 | 4599

Then $4599\div 9=511$, the Remainder, So $2423\frac{511}{1111}$ is the Quotient required.

(18) Firſt, 4769042

$\times 9$

10000)4292 | 1378

| 4292

7)4292 | 5670

613—1

Then $5670\div 9=630$, and $630+1111=1741$, the Remainder; ſo the Quotient is $613\frac{1741}{7777}$.

(19) 109494

9

10000)98 | 5446

6)98

16—2

Then $5446\div 9=605$, and $6+11+2222=2838$ the Remainder, ∴ $16\frac{2838}{6666}$ is the Quotient required.

(10) COMPOUND DIVISION.

MONEY.

Here, in the 3d Example, I divide by 8, ſaying the 8's in 17 is 2 Times and 1 over, the 8's in 11 is 1 and 3 over, which is 3£. this 3£. I carry to the 11*s.* and it is 3£. 11*s.* or 71*s.* then I ſay the 8's in 71 is 8 times 8 is 64, and 7*s* over, which I carry to the 4 Pence, and is 7*s.* 4*d.* or 88 Pence; then I ſay the 8's in 88 is 11 Times, and nothing over, and ſo the Quotient is £.21 8*s.* 11*d.* in the ſame Manner proceed with all the reſt.

(1)

(1) £. s. d.
2)14 16 10½
Quot. 7 8 5¼

(2) £. s. d.
7)267 0 0
38 2 10¼ $\frac{1}{7}$

(3) £. s. d.
8)171 11 4
21 8 11

(4) £. s. d.
9)317 0 6
Quot. 35 4 6

(5) £. s. d.
11)6 6 11½
0 11 6½

(6) £. s. d.
3)7 11 6
2 10 6

(7) £. s. d.
10)3 17 1
Qu. £. 0 7 8½

(8) £. s. d.
12)14 14 0
£. 1 4 6

(9) £. s. d.
16 { 4)45 12 8
4)11 8 2 }
£. 2 17 0½

(10) £. s. d
24 { 4)3 13
6)0 18 3 }
£. 0 3 0½

(11) £. s. d.
36 { 6)64 19
6)10 16 6 }
£. 1 16 1

(12) £. s. d.
42 { 6)190 4 6
7) 31 14 1 }
£. 4 10 7

(13) £. s. d.
48 { 6)37 14 8
8) 6 5 9¼ }
£. 0 15 8½

(14) £. s. d.
32 { 4)78 16 8
8)19 14 2 }
£. 2 9 3¼

(15) £. s. d.
55 { 5)4567 0 10
11) 913 8 2 }
£. 83 0 8¼

(16) £. s.
63 { 7)264 12
9) 37 16 }
£. 4 4

(17) £. s. d.
72 { 8)18 18
9) 2 7 3 }
£. 0 5 3

(18)

(18) £. s. d.

81 { 9)121 12 6

9) 13 10 $3\frac{3}{4}$

1 10 $0\frac{1}{4}\frac{13}{27}$

(19) £. s. d.

120 { 10(174 1 8

12) 17 8 2

1 9 $0\frac{2}{3}$

(20) £. s. d.

17)214 17 $9\frac{1}{4}$(12£.

44

Rem. 10£.

20

17)217(12*s.*

47

Rem. 13*d.*

12

17)165)9*d.*

Rem. 12*d.*

4

17)49($\frac{1}{2}$ qrs.

Rem. 15

17

Anſw. £. 12 12 $9\frac{1}{2}$)$\frac{15}{17}$

(21) £.

145(476 0 0(3£.

435

41

20

145(820(5*s.*

725

95

12

145)1140(7*d.*

1015

125

4

145)500($\frac{3}{4}$

435

$\frac{65}{145}$

Anſw. £. 3 5 $7\frac{3}{4}$)$\frac{66}{145}$

(22) £. s.

112 { 4)30 2

4) 7 10 6

7) 1 17 $7\frac{1}{2}$

£. 0 5 $4\frac{1}{2}$

(23) £.

350 { 5)1009

7) 201 16

10) 28 16 $6\frac{1}{2}$

£. 2 17 $7\frac{3}{4}$

(24) £. s.

224 { 4)610 8
7)152 12
8) 21 16

£. 2 14 6

(25) £.

640 { 8)1426
8) 178 5
10) 22 5 7½

£. 2 4 6¾

(26) £. s. d.

6¼
4
—
25
{ 5)12 12 11
5) 2 10 7

0 10 1¼ per. Qr.
4

£. 2 0 5

(27) £. s. d.

10½
2
—
21
{ 3)1061 8 9¾
7) 353 16 3¼

50 10 10¾
2

£. 101 1 9½

(28) £. s. d.

8¾
4
—
35
{ 5)450 13 11½
7) 90 2 9¼—3

12 17 6—$\frac{1}{4}\frac{33}{35}$
4

£. 51 10 $1\frac{1}{4}\frac{27}{35}$

WEIGHTS, MEASURES, &c.

lb. oz. dwt. grs.
(1) 2)8 1 15 8
Quot. 4 0 17 16

T. C. qrs. lb.
(2) 3)24 14 0 14
8 4 2 23⅓

C. qrs. lb. oz. drs.
(3) 4)17 2 27 14 15
Quot. 4 1 20 15 11¾

lb. ℥ ʒ ℈ grs.
(4) 5)4 11 4 2 12
0 11 7 1 2⅖

(5)

Yds. qr. na.	*E.E. qr.*	*Lea. m. fu. p.*
(5) 9)214 3 2	(6) 8)120 4	(7) 9)12 2 0 26
Quot. 23 3 2	15 0 2	1 1 1 34

Yds. f. in. b.c.	*W.hhds. gal.*	*Tu. p. hd. g. qt.*
(8) 10)147 2 11 2	(9) 11)24 57	(10) 8)10 1 1 60 3
14 2 4 $2\frac{3}{10}$	2 16 $5\frac{1}{11}$	1 0 1 31 $0\frac{7}{8}$

Tier. g. pts.	*Hhds. gal.*	*B.hds. g. qts.*
(11) 6)16 20 7	(12) 5)76 27	(13) 4)12 49 2
Quot. 2 31 $3\frac{5}{6}$	15 15	3 12 $1\frac{1}{2}$

B.b. fi. g.	*A. r. p.*	*La. qr. bu. p.*
(14) 3)61 2 6	(15) 12)140 2 26	(16) 7)60 6 7 2
Quot. 20 2 2	11 2 $35\frac{1}{2}$	8 6 5 $2\frac{4}{7}$

	D. h. m. ſec.
(17)	6)146 23 24 56
Quot.	24 11 54 $9\frac{1}{2}$

APPLICATION.

(1) Thus, 22,0000÷1,0000=22*l.* each Perſon.
(2) Thus, 336÷12=28 Miles per Day.
(3) Firſt, 4429÷43=103, then 240—103=137 the Anſ.
(4) Firſt, 2262÷26=87, and 2262÷87=26.
Then 87—26=61, the Number required.
(5) 5190048÷72084=72 the Number required.
(6) Firſt, 419844÷3=139948 the Remainder.
And 419844×9304=3986998936 Pro. of Div. and Quot.
Then 3985998936+139948=3986138884 the Anſwer.

(7) Firſt, $360-144=216$ the greater Number.
And $216-144=72$ their Difference.
Alſo $261\times144=31104$ Product.
Likewiſe $216\div144=1\frac{72}{144}$ or $1\frac{1}{2}$ the larger Quot.

(8) Firſt 3 Tons$=3\times20=60$ Cwt. then $60\div15=4$ Cwt. per Man the Anſwer.

(9) Firſt, $22525\div25=901$ and $9696\div16=606$. Then $1440+901=2341$, and $2341-606=1735$ the Anſ.

(10) Firſt $134\times71=9514$, conſequently $9514\div57=166\frac{52}{57}$ the Anſwer.

(11) Fourſcore and thirteen Millions$=93000000$. Then $93000000\div30079=3091$, and the Remainder is 25811, from which deduct 21180, leaves 4631 Exceſs, the Anſwer.

(12)

	£.	s.	
2,0)1640 Guineas. +82			
£. 1722 - -	1722	0	College.
×4			
£. 6888 - -	6888	0	Wife.
—1383			
2)5505 - -	5505	0	Daughter.
+2752 10			
£. 8257 10 -	8257	10	Eldeſt Son.
2)12393 0 Sum of the Mo.& Siſt.			
£. 6196 10 -	6196	10	Youngeſt Son.
	988	10	Expences on his Burial.
	29557	10	died worth.

Then from 30000 take 29557 leaves £. 442 10s.

(13)

	s.	d.	
	8)12	8	Worth of both.
	1	7	Ditto of the Purſe.
Anſwer, £.	11	1	Caſh in Ditto.

(14)

	£.	s.	d.	£.	s.	d.	
Brother owed at firſt	74	18	2				
Paid in Part, -	—41	14	8				
Remains on Balance,	2)33	3	6	33	3	6	Bro.
Half of which is	+16	11	9				
Siſter owed at firſt,	49	15	3				
Paid in Part, -	—13	12	10				
Remains on Balance,	36	2	5	36	2	5	Siſter.
To which add the Brother's,	33	3	6				
Uncle William owed,	69	5	11				
Paid in Part -	—24	7	3				
Rem. on B. unpaid by him,	44	18	8	44	18	8	Uncle.
All together owed, -			£.	114	4	7	

Then from 150*l.* take £. 114 4 7 leaves £. 35 15 5

(15)

	C.	qrs.	lb.			£.	s.	d.
Weight together,	9	3	16		Coſt,	97	17	6
Difference,	—1	2	16		Diff.	8	13	3
	2)8	1	0	Rem.		2)89	4	3
Leſſer Weight,	4	0	14		Coſt, £.	44	12	1½
Difference,	+1	2	16		Diff.	8	13	3
Greater Weight,	5	3	2		Coſt, £.	53	5	4½

(16) £.
In Caſh - 10000
Bills, £. 54 10 6×8=436 4

Left in all, £. 10436 4
Debts, &c. 36+260=296 0

9)10140 4 0 Neat.
Daughter had, £. 1126 13 $9\frac{1}{4})\frac{1}{3}$

7)9013 10 $2\frac{1}{2}\ \frac{2}{3}$

Sons had each, £. 1287 12 $10\frac{1}{2}\frac{1}{9}\frac{5}{8}$

(17)

Firſt, 2072÷14=148 Elms in each Row; then 148—1=147 Vacancies, and 147×25=3675 Feet, or 1225 Yards, the Length of the Grove required.

(18)

$32\begin{cases}4)384\\ 8)\ 96\end{cases}$

Anſ. in Rank 12 Men.

(19)
First 129+178=307
Then 1000—307=693
$\left.\begin{array}{ll}\text{And} & 693\div3=231\text{ B.'s}\\ \text{Alſo} & 231+129=360\text{ A.'s}\\ \text{Likewiſe} & 231+178=409\text{ C.'s}\end{array}\right\}\text{Crowns}$

(20) Firſt 37—28=9, then 250—9=241.
∴3)241
$\left.\begin{array}{ll}\text{gives} & 80\frac{1}{3}\text{ B.'s}\\ \text{And }80+37= & 117\frac{1}{3}\text{ A.'s}\\ \text{Alſo }80-28= & 52\frac{1}{3}\text{ C.'s}\end{array}\right\}£.$

(21) 207+213+189+234+522+220=1315 the Sum; which being divided by 5, the Times each being mentioned, viz. - - - 5)1315

Quotient, - - 263
To which add Fourſcore and 13= 93

Sum, - - 356
From which deduct - - 1
Leaves, Anſwer, - 355

(22) £.

Firſt $10000-8500=1500$ O.'s - -
And $8500-6050=2450$ L.'s - -
Then $6050-420=5630$, and $5630\div2=2815$ M.'s
Conſequently $2815+420=3235$ N.'s
} Subſcription.

(23) $46)1610(35$ the leſſer N° then $46+35=81$ their Sum, and $46-35=11$ their Difference; alſo $46\div35$ $1\frac{11}{35}$ their Quotient.

Then $46\times46=2116$ the Square of greater Number.
And $35\times35=1225$ ———— leſſer.

3341 Sum of thoſe Squares.

Again, $11\times11\times11=1331$ the Cube of their Difference.

(24)

Firſt $7050\div94=75$ the leſſer Number.
And $7050\times7050=49702500$ the Square of the greater.
Alſo $75\times75=\ldots.5625$ Ditto of the leſſer.

49696875 Difference of thoſe Squares.

Again $7050+75=7125$ their Sum, and $7050-75=6975$ the Difference; then $7125\times6975=49696875$ the Product of their Sum and Difference.

Conſequently $49696875\times49696875=2469779384765625$ the Square of the Product of their Sum and Difference.

(25) Suppoſe the Expence or Profit to be 2.
Then $2\times2=4$ Double the Expence.
And $2\div2=1$ Half the Profit.
Anſwer, Difference 3, or as 4 to 1.

(26) Firſt B. is to have 72
And C. $72+112=184$
} more than A.

Sum, 256

Then $1500-256=1244$
∴ $3)1244$

gives $414\frac{2}{3}$ A.'s
And $414\frac{2}{3}+72=486\frac{2}{3}$ B.'s
Alſo $486\frac{2}{3}+112=598\frac{2}{3}$ C.'s
} Share.

(27) Firſt 25000+33000+33000+28000+32000=148000 their Sum; then each being repeated four Times, that Sum muſt be divided by 4, viz.

4)148000

Which gives 37000£. Sum of their Fortune, then

From	Take	Rem.	
£. 37000	25000=	12000 £.	the Youngeſt's Fortune.
	33000=	4000 ——	Eldeſt's.
	30000=	7000 ——	Second's.
	28000=	9000 ——	Fourth's.
	32000=	5000	Miſs Charlotte's Fortune.
	Proof,	37000 £.	

(28)

		d.	s.	d.	
Firſt	120 at 2 for 1*d.*=120÷2=	60 or	5	0	
And	120 at 3 —— =120÷3=	40 =	3	4	
			8	4	Coſt.
Then	240 at 5 for 2*d.*=240÷5=48 Two-pences, or		8	0	Sold for
	Difference.		0	4	Loſt.

(29)

	£.	s.	d.
A. and B. had	13	10	0
B. and C.	12	12	0
A. and C.	11	16	6
Sum, £.	37	18	6

Which being divided by the Number of Players at each Time will give the Sum won, viz.

£. 37 18 6÷2=18 19 3 what was won.
(£. s. d.)

	£.	s.	d.		£.	s.	d.		£.	s.	d.		
Then from	18	19	3	Take	13	10	0	Rem.	5	9	3	C.'s	Gain.
					12	12	0		6	7	3	A.'s	
					11	16	6		7	2	9	B.'s	

	£.	s	
(30) W. X. and Y. advanced	350	10	
W. X. and Z.	344	10	
X. Y. and Z.	400	0	
W. Y. and Z.	378	4	
They being mentioned each 3 Times. }	3)1473	4	Sum.
	£. 491	1	4 joint Property.
Sold for 450 Guineas, or	472	10	0
Anſwer, loſt £.	18	11	4

(31) Worth at the End of 3¼ Years,	3179	11	8
	4)100£.= 25	0	0
3¼ Years=13 Quarters,	13)3204	11	8
	—246	10	1½
Worth at the End of 3 Years, £.	2958	1	6½
	+ 100	0	0
	4)3058	1	6½
	— 764	10	4½
Worth at the End of 2 Years,	£. 2293	11	2
	+ 100	0	0
	4)2393	11	2
	— 598	7	9½
Worth at 1 Year's End,	£. 1795	3	4½
	+ 100	0	0
	4)1895	3	4½
	— 473	15	10
Anſwer, He began with,	£. 1421	7	6½

(32) £.

Firſt, 10÷5=2£. each Man's Share, ſuppoſing they had attended equally.

And 2£.÷7=5*s*. $8\frac{4}{7}$*d*. each Man's daily Pay.

Then 5*s*. $8\frac{4}{7}$*d*.×2=11*s*. $5\frac{1}{7}$*d*. what C. and D. muſt each forfeit.

∴ 11*s*. $5\frac{1}{7}$*d*.×2=£. 1 2 $10\frac{2}{7}$*d*. C. and D.'s whole Defaults.

And £. 1 2 $10\frac{2}{7}$*d*. ÷3=7*s*. $7\frac{3}{7}$*d*. what A. B. and E. each received of C. and D.'s Default.

Alſo 5*s*. $8\frac{4}{7}$*d*.÷4=1*s*. $5\frac{1}{7}$*d*. what A. B. C. and D. each received of E.'s Default.

Therefore, 2£.+7*s*. $7\frac{3}{7}$*d*.+1*s*. $5\frac{1}{7}$*d*.=	2	9	$0\frac{4}{7}$	A.	Received.
Ditto, - -	2	9	$0\frac{4}{7}$	B.	
2£.+1*s*. $5\frac{1}{7}$*d*. leſs 11*s*. $5\frac{1}{7}$=	1	10	0	C.	
Ditto, - -	1	10	0	D.	
Alſo, 2£+7*s*. $7\frac{3}{7}$*d*. leſs 5*s*. $8\frac{4}{7}$*d*.=	2	1	$10\frac{6}{7}$	E.	

33) Firſt 12—1=11, and 11×2=22 ſhe had before ſhe met the laſt Boy; then 22—2+10=30 ſhe had before ſhe met the ſecond Boy; conſequently 30—10=20 what ſhe had before the firſt returned her back 10; ſo that 20 being multiplied by 2=40, the Number of Apples ſhe had at firſt.

(11) REDUCTION.

MONEY.

(1) 130£.
20
2600 Shillings.
12
31200 Pence.
4
124800 Farthings.

(2) 4)24000 Qrs.
12)6000 Pence.
2)500 Shillings.
25 £.

(3) £. 80 15 $11\frac{3}{4}$
20
1615
12
19391
4
77567 Farthings.

(4) 4)16921 Qrs.
12)$4230\frac{1}{4}$
2,0)35,2 6
£. 17 12 $6\frac{1}{4}$

(5) £. 110 0 6½
20
2200
12
264 6
2
52813 Half-pence.

(6) 2)20553 Half-pence.
12)10276½
2,0)85,6—4
£. 42 16 4½

(7) £. 107 10 8
20
2150
6 Two-pences=1*s.*
12904 Two-pences.

(8) 6)5348 Two-pences.
2,0)89,1 2 over=4*d.*
£. 44 11 4

(9) £. 6 17.0
20
137
4 Three-pences=1*s.*
548 Three-pences.

(10) 4)2782 Three-pences.
2,0) 69 5—2 or 6*d.*
£. 34 15 6

(11) £. 10 10
20
210
3
632 Four-pences.

(12) 3)3859 Four-pences.
2,0)128,6 4
£. 64 6 4

(13) £. 200 17 0
20
4017
2
8034 Six-pences.

(14) 2)795 Six-pences.
2,0)39,7—6
£. 19 17 6

Any Number of Pounds, &c. may be reduced to Six-pences, Four-pences, Three-pences, or Two-pences, by multiplying the Pounds by as many of each Denomination that make one Pound; that is, to reduce Pounds, &c. to Six-pences, multiply by 40, if to Four-pences by 60, if to Three-pences by 80, and if to Two-pences by 120, obſerving to add in the odd Shillings and Pence, if any; accordingly, on the contrary, any Number of Six-pences, Four-pences, &c. may be reduced to Pounds, by dividing by as many as make one Pound, obſerving to value the Remainder (if any) right; thus, the two laſt Examples.

(13)
£. 200 17.0
40+34 Sixpences=17*s.*
8034 Sixpences.

(14) Six-pences. *s. d*
4,0)795 & 35 over=17 6
£. 19 17 6

(15) 21 Guineas.
7×3=21
147
3
441 Shillings.
12
5292 Pence.
4
21168 Farthings.

(16) 4)24192 Farthings.
12)6048
21 { 3)504
7)168
24 Guineas.

17) 12 Moidores.
27
324
12
3888
4
15552 Farthings.

(18) 12)3240 d.
27)270
10 Moidores.

(19) 30£.
4
120 Crowns.
2
240 Half Crowns.
30
7200 Pence.

(20) 3,0)2016,0 Pence.
2)672 Half Crowns.
4)336 Crowns.
84 £.

(21) 25 Crowns.
5
125 Shillings.
3
375 Groats.
4
1500 Pence.

(22) 4)25200 Pence.
3)6300 Groats.
5)2100 Shillings.
420 Crowns.

(23) 25 £.
20
5)500 Shillings.
100 Crowns.
60
6000 Pence.

(24) 80 Crowns.
5
2,0)40,0 Shillings.
20£.

(25) A Crown=60
Half do.=30
Shilling =12
One of each 102

£. 213 15 · 6
20
4275
12
102)51306(503 of each
510
306
306
. . .

(26) 120 £.
8
2)960 Half Crowns.
480 Crowns.
15
3)7200 Groats.
2400 Shillings.

(27) A Crown=5 0
Half do.=2 6
Shilling =1 0
Groat =0 4
Sum, 1 of each=8 10
6×6=36
2 13 —
6
£. 15 18 —

(28) £. 470 17.0
20
$27\begin{cases}3\\9\end{cases}$ 9417 Shillings.
3139
348 Moidores, and 21 Shillings over.

(29)

240 Guineas
7×3 21

1680
3

5)5040 Shillings.

4)1008 Crowns.

252 £.

(30) £. s.
21 Guineas=22 1
A Crown =0 5
A Moidore= 1 7

In each Purſe, 23 13
7×3=21

165 11
3

Anſwer, £. 496 13

(31) Firſt, 4*s.* 3*d.*=17 Three-pences.
And, 1178×17=20026 Ditto.
Then, 2002,6÷8,0=£. 250 6 6 the Anſwer.

(32) Firſt, 17*s.* 6*d.*=35 Six-pences.
And, 1£.=40 Ditto.
Then, 470 Piſtoles.
7×5=35

3290
5

4,0)1645,0

Anſw. £. 411 5*s.*

(33) Firſt, 5*s.* 3*d.*=21 Three-ds.
And, £.249 7*s.* 6*d.*=19950 Ditto.
Then, 19950÷21=950 Q. Guin.

(34) Firſt, 3*s.* 2*d.*=19 Two-pences.

£. *s.* *d.*
387 18 4
20

7758
6

19)46550

2450 Florins.

(35) Firſt, 5*s.* 4*d.*=32 Two-pences, and 18*s.* 6*d.*=111 Ditto. Now, 474×111=52614 Ditto. Therefore 52614÷32=1644 Crs. 1*s.* the Anſwer.

(36) *Moidores.*

1240
9×3=27

11160
3

21 { 3)33480 Shillings.
7)11160

Anſw, 1594 Gu. 6*s.*

WEIGHTS, MEASURES, &c.

(1) 14 *lbs.*
12

168 Ounces.
20

3360 dwts.
6×4=24

20160
4

80640 Grains.

(2) 24 { 4)138240 *grs.*
6) 34560

2,0)576,0

12)288

24 *lb.*

(3)

(3) *lb. oz. dwt. grs.*
19 10 17 22
12

238
20

4777
6×4=24

28662
4

114670 Grains.

(4) *grs.*
24 { 4)74342
6)18585—2 }
2,0)309,7—3 } 14 grs.
12)154—17 dwts.

Answ. *lb.* 12 10 17 14

(5) *lb. oz. dwt. grs.*
4 6 0 22
12

54
20

1080
6×4=24

6480
4

25942 grs.=1 Ingot.
4

A. 103768 *grs.*

(6) *lb. oz. dwts.*
6 11 14
12

83
20

1674
6×4=24

10044
4

40176)241056(6 Ingots.

(7)

	lb.	*oz.*	*dwt.*	*grs.*
One Dozen of Dishes, each Weight	2	1	15	0
Ditto ——— Plates, ———	1	3	15	22
One of each - - -	3	5	10	22
				12
Answer, *lb.*	41	6	11	0

(8)

		oz.	dwt.	grs.
Bowls,	each	24	4	0
Tankards,	-	11	14	0
Tea Pots,	-	10	10	0
Lamps,	-	20	17	21
Pl. per Dozen,		127	11	0
Spoons, ditto,		36	17	23
One of each,		231	14	20

20

4634

6×4=24

27804

4

111236)218440(1 of each.

oz. dwt. grs.

455 1 16

20

9101

6×4=24

54606

4

218440 grs.

Rem. 107208 *grs.*=223 *oz.* 6 *dwts.* 20 *grs.*

Anſwer, 1 of each Sort, and 223 *oz.* 6 *dwt.* 20 *grs.* over.

(9) *lb.* ℥ ʒ ℈ *grs.*

4 10 4 1 12

12

58

8

468

3

1405

20

28112 Grains.

(10) *grs.*

2,0)5993,4

3)2996—14 *grs.*

8) 998—2℈

12) 124—6ʒ

lb. 10 4 6 2 14

(11)

(11) 6 Tons.
20
120 Cwts.
4
480 qrs.
$7\times4=28$
3360
4
13440 *lb.*

(12) 28 { 4)26880 *lb.*
7) 6720
4)960
2,0)24,0
12 Tons.

(13) *C. qrs. lb. oz. drs.*
74 2 16 0 7
4
298
$7\times4=28$
2086
4
8360
16
133760
16
2140167 drs.

(14) *oz.*
16 { 4)29768
4) 7442 } 8 oz.
28 { 4)1860—2
7) 465 } 12 lb.
4)66—3
C. 16 2 12 8

(15) *lb. oz. drs.*
67 12 15
16
1084
16
17359 drs.

(16) *C. qrs. lb.*
6 3 27
4
27
$7\times4=28$
189
4
783 lbs. in 1 Hhd.
6
Anſwer, 4698

(17)

(17) *C. qrs.*
11 2
4
46
7×4=28
322
4
lb. Hds.
1288)12880(10 Anſwer.

(18) *C.*
A Fother=19½
×2
39

507 *C.*
2
39)1014(26 Fother
234
...

(19) *C. qrs. lb.*
12 3 12
4
51
7×4=28
357
4
12)1440
120 Caniſters the Anſw.

(20) *lb.* *C. qrs.*
126½ 8 3
2 4
253 35
7×4=28
245
4
980 lb.
2
253)1960(7 Parcels, and
Remains 189 half-lbs.=3 qrs. 10½lb. over.

(21) 6+8+12+16=42 *lb.* One of each.
C. qrs. lb.
4 3 24
4
19
28
556
2
42 { 6)1112 lbs.
7) 185—2
26—3 } 20 lbs.
Anſ. 26 of each, 20lb.

(22)
24 lb. great.
3
2)72
36 lb. common.

(23)
120 lb. common.
2
3)240
80 lb. great.

(24)

(24) *Yds. qrs.*
27 3
4
111
4
444 Nails.

(25) 4)352 Nails.
4)88
22 Yards.

(26) *E.Eng. qrs. na.*
30 4 3
5
154
4
619 Nails.

(27)
4)569 Nails.
3)142—1
E. Fl. 47 1 1

(28) 24 Yards.
4
96
4
384 N.=1 Piece.
14
Anſ. 5376 Nails.

(29) 4)24768 Nails.
4)6192
12)1548
Anſw. 129 Pieces.

(30) *E. Fl.*
20 each
3
60 qrs. in 1 Piece.
12
5)720
144 Ells Engliſh.

(31) *E. Fl.* *Yards.*
24 227
3 4
72 { 8)908
9)113—4 }
12—5 } 44 Qrs.
Anſw. 12 Ps. in 11 Yards.

(32) 24 *E. Fl.*
3
72 Qrs. in 1 Piece.
12
864 Qrs. in 12 Pieces.
4
5)3456 Qrs. in 4 Bales.
E. Eng. 691—1 Qr.

(34) 4,0)1280,0 Poles.
8)320
Anſw. 40 Miles.

(36) 3)2280060 B. Crs.
12) 760020
3) 63335—2
176,0) 2111,1(11 Miles.
351
22,0) 1751(7 Furlongs.
211
2
11)422(38 Poles.
Remains 4 half Yards.
=2 Yards 2 Feet.
Anſwer, 11 Miles, 7 Fur.
38 Poles, 2 Yards, 2 Feet.

(33) 60 *Miles.*
8
480 Furlongs.
40
19200 Poles.

(35) 16 Miles.
1760 Yards in 1 Mile.
28160 Yards.
3
84480 Feet.
12
1013760 Inches.
3
3041280 Barley Corns.

(37) 276 Miles.
1760
1656
4692
485760 Yards.
6×6=36
2914560
6
17487360 Inches.
3
52462080 B. C.

(38) *Feet.*
First 18½=37 Half-Ft.
Miles.
197
1760
1182
3349
346720 Yards.
6
2080320 Half-Ft.
which divide by 37=
56224$\frac{32}{37}$ Times, the
Anſwer.

(39) *M. fur.*
69 4=1°
8
556 [in 1 Fur.
11×20=200 Yards
6116
20
122320 Yards in 1°.
6×6=36
733920
6
4403520 Inches in 1°.
3
13210560 Bar. C. in 1°
6×60=360°.
79263360
60
Anſw. 4755801600 Barley Corns.

(40) [illegible] Acres.
4
256 Roods.
40
10240 Poles.

(41) 4,0)2176,0 Poles.
4)544
Anſw. 136 Acres.

(42) 774 Acres.
4
3096
4,0
270 { 3,0)12384,0
9)4128
Anſwer, 458 & 180 Poles over.

(43) A. r.
Rents 200 0
Tills 96 2
Rem. 103 2
4
414
40
Anſ. 16560 Perches.

(44) 12 Tierces.
42
504 Gal.
8
4032 Pts.

(45) 8)6048 Pts.
42 { 6) 756
7) 126
18 Tierces.

(46) Hhd. gal. qts.
4 42 2
63
294
4
Anſw. 1178 Qts.

(47) 8)5746 Pts.
63 { 7) 718—2 Pts.
9) 102—4 }
11—3 } 25 Gal.
Anſw. 11 hds. 25 gal. 2 pts.

(48) Gal.
A Pipe=126
4
12)504 Gal.
Anſw. 42 Doz.

(49) A Tun=252 Gal.
A Quart=4 Half-Pts. 4
A Pint =2
Half-Pt.=1 1008 Qts.
4
7)4032= Half-Pts.
Anſw. 576 of each.

(50)
A Pipe = 126 Gal.
A Punch = 84
A Hogſh. = 63
A Tierce = 42
Sum, 315)1890(6 of each.
....

(51) 12 A. Bar.
32
384 Gall.
8
3072 Pints.

(52)
8)1704 Pts.
32)213(6 Bar. 21 Gal.
Rem. 21 Gal.

(53) *B.Bar.ſir.gal.*
6 2 7
4
26
9
Anſw. 241 Gal.

(54) *A.hds.gal.pts.*
10 42 4
48
522
8
4180 Pints.

(55) 4)2017 Qrs.
48 { 6) 504—1 Qt.
{ 8) 84
Hhds. 10 24 1

(56) 12 B. Hhds.
3
2)36 Half Barrels.
Anſwer, 18 Barrels.

(57) 18 A. Bar.
2
3)36 Half Barrels.
Anſw. 12 Hhds.

(58) *T. b. hds. gal*
Gal. 4 1 1 49
A Hhd.=54 2
A Bar. =36 —
A Fir. = 9 9
— 2
Sum, 99 —
— 19
54
99)1075(10 of each, and 85 Gal. over.
Rem. 85 Gal.

(59) 24 Qrs.
8
192 Buſh.
4
768 Pecks.
2
1536 Gal.

(60) 2)3360 Gal.
4)1680
8)420
Anſw. 52 qrs. 4 Buſh.

(61) *La. qrs. bu.*
42 4 7
10
424 Qrs.
8
3399 Buſhels.

(62) 40 Chal.
36
1440 Buſh.
4
Anſw. 5760 Pecks.

(63)
36 { 6)4762 Buſh.
6) 793—4 }
132—1 } 10 Buſh.
Cha. 132 10

(64) *Cha. bu.*
47 30
6×6=36
282
6
3)1722
Anſw. 574 Sacks.

(65) 12)6450 Sacks.
Anſw. 537 Ch. 6 Sacks.

(66) D. H.

365 6

6×4=24

2190

4

8766

60

Anſ. 525960 Minutes.

(67) 6,0)207360,0 Sec.

6,0)3456,0

$24\begin{cases}4)576\\6)144\end{cases}$

Anſwer, 24 Days.

(68) D. h. m. ſec.

27 7 43 5

6×4=24

162

4

655

60

39343

60

Anſ. 2360585 Seconds.

(69) D. h. m. ſec. ‴

365 5 48 57 39

6×4=24

2190

4

8765

60

525948

60

31556937

60

Anſwer, 1893416259 Thirds.

(70) 6,0)3155760,0 Sec.

6,0) 52596,0

$24\begin{cases}4)8766\\6)2191—2\end{cases}$

$\left.\begin{matrix}2191—2\\365—1\end{matrix}\right\}$ 6 Hours.

Anſw. 365 D. 6 H.

(71)

(71) D. h.
365 6
6×4=24
2190
4
8766 Hours in 1 Year.
1784 Years ſince.
35064
70128
149022
24 { 4 } 15638544 Hours in 1784 Years.
{ 6 } 3909636
Anſwer, 651606 Days.

(72) Years.
London built 1108 before the Birth of our Saviour.
1789 ſince
Hours.
In all, 2897 Then 365 d. 6 h.=8766 by laſt Ex.
2897
61362
78894
122724=2×14=28
24 { 4 } 13122702
{ 6 } 3280675—2
Anſwer, 546779 Days.6H.

Real Answer 1058129 Days 6 hrs
Wrong Answer

12. THE RULE OF THREE DIRECT.

Yds. *s.* *Yds.*
(1) If 3—18—17
17
3)306
2,0)10,2
Anſwer, £. 5 2 0

(2) *lb.* *d.* *lb.*
St. thus—If 2 : 18½::24
4
74
6×4=24
4444
2)1776
4) 888
12) 222
Anſw. 18*s.* 6*d.*

lb. *s.* *d.* *lb.*
If 24 : 18 6 :: 2
12
222
2
24 { 4)444
6)111
Proof, 18½*d.*=1*s.* 6½*d.*

Or wherever the firſt and ſecond Terms conſiſt of any Numbers that are in the Multiplication Table; then the moſt expeditious Way will be to multiply and divide as in Sect. 9 and 10. — Thus the laſt Example will be performed as follows.

(2) *lb.* *s.* *d.* *lb.*
If 2 : 1 6½ : : 24
6×4=24
9 3
4
2)1 17 0
Anſ. £. 0 18 6

lb. *s.* *d.* *lb.*
If 24 : 18 6 :: 2
2
24 { 4) 17 0
6)0 9 3
Proof, 1*s.* 6½*d.*

But in Teaching I would adviſe the Tutor to follow the general Rule, to make his Pupil perfect therein, after which he will, with more Eaſe both to himſelf and Maſter, learn the Abbreviations.

lb. *s.* *doz.* *lb.*
(3) Stated thus—If 4 : 2 :: 6 or 72
Or, as 4 : 30*d.* :: 72 : 540 Pence.

For 72×30=2160, this ÷ 4=540 Pence, which ÷ by 12 and 20, will give £. 2 5*s.* the Anſwer.

Or, 2*s.* $\overline{6\times9\times8}\div4$=£. 2. 5.—

C. *s.* *C.*
(4) Stated thus—If 1 : 26 :: 40

Then $\overline{26\times40}\div20$=1040÷20=52£. the Anſwer.

Or thus, £. 1 6*s.*×8×5(40)=52£.

(5) Stated thus—If 1 oz. : 7½ :: 1 Cwt. or 112
Or, as 1 : 15 :: 1292 : 26880 Half-pence.

For by Reduction 7½*d.*=15 Half-pence and 112*lb.*=1792 *oz.* conſequently 1792×15=26880 Half-pence, which divide by 2, 12, and 20, will give 56£. the Anſwer.

oz. *s.* *d.* *oz.*
(6) Stated thus—If 1 : 5 4 :: 36
Or, as 1 : 16 :: 36 : 576 Four-pences.

For by Reduction 5*s.* 4*d.*=16 Four-pences; theſe × by 36 (the third Term)=576 Four-pences, which ÷ by 60 will give £. 9 12*s.* the Anſwer.

Or thus, 5*s.* 4*d.*×6+6(36)=£. 9 12*s.*

Yd. *s.* *d.* *Ps.* *Yds.*
(7) Stated thus—If 1 : 17 6 :: 12 each 30
Or, as 1 : 35 :: 360 : 12600 Six-pences.

For by Reduction 17*s.* 6*d.*=35 Six-pences, and 12×30= 360 Yards, conſequently 360×35=12600 Six-pences, theſe ÷ by 40 will give 315£. the Anſwer.

Or thus, 17*s.* 6*d.*+10×6×6(360)=315£.

lb. *s.* *d.* *C.* *lb.*
(8) Stated thus—If 1 : 7 9 :: 1 or 112
Or, as 1 : 31 :: 112 : 3427 Three-pences.

For by Reduction 7*s.* 9*d.*=31 Three-pences, theſe × by 112 (the laſt Term)=3472 ditto, which ÷ by 80, will give £. 43 8*s.* the Anſwer.

Or thus, 7*s* 9*d.*×4×7×4(112)=£. 43 8*s.*

(9) Firſt, Coſt £. 34 6*s.* gained 6 £. which added together, =£. 40 6—to be ſold for—then

Stated

C. qrs. lb. £. s. lb.

Stated thus—If 2 1 14 : 40 6 :: 1

Or, as 266*lbs.* : 806*s.* :: 1 *lb.* : 3*s.* 0¼$\frac{118}{266}$

For by Reduction 2*C.* 1 *qr.* 14*lb.*=266*lb.* and £. 40 6*s.*= 806*s.* which ÷ by 266 will give 3*s.* 0¼*d.* $\frac{118}{266}$ the Anſwer.

(10) Firſt, Coſt 90£. loſt £. 7 10; Difference £. 82 10 ſold for. Then,

Yds. £. s. El. Eng.

Stated thus—If 200 : 82 10 :: 1

Or, as 800 Qrs. : 1600*s.* :: 5 Qrs. : 10*s.* 3¾*d.*

For by Reduction 200 Yards=800 Qrs. and £. 82 10= 1650*s.* which × by 5 (the laſt Term)=8250*s.* theſe ÷ by 8,00 (the firſt Term) will give 10*s.* 3¾*d.* the Anſwer.

(11) *Doz. lb. £. s. lb.*

Stated thus—If 9 or 108 : 2 5 :: 4

Or, as 108 : 45*s.* :: 4 : 1*s.* 8*d.*

For 45×4=180*s.* theſe ÷ 108 will give 1*s.* 8*d.* the Anſwer.

Or thus, $\overline{45\times2}$÷9×12(108)=1*s.* 8*d.*

(12) *lb. d. Hhs. C. qrs. lb.*

Stated thus—If 1 : 6½ :: 4 each 12 2 24

Or, as 1 : 13 Half-pence :: 5696 : 74048

For by Reduction 6½*d.*=13 Half-pence, and 12 *C.* 2 *qrs.* 24 *lb.*=1424 *lb.* in one Hogſhead, which × by 4 the Number of Hhds.=5696*lb.* theſe × by 13 (the ſecond Term)=7408 Half-pence, which ÷ 2, 12, and 20, will give £. 154 5*s.* 4*d.* the Anſwer.

(13)

	£.	s.
Coſt, - -	579	12
Freight, -	46	0
Loading, &c. -	6	0
Cuſtom, - -	10	0
Cellar, - -	4	0
Gain, - -	360	0

Tuns.——*Tuns.*

Stated thus—If 46 : 1005 12 :: 26

Or, as 46 : 20112*s.* :: 26 : 11367*s.* 7¾*d.*$\frac{34}{46}$.

For by Reduction £. 1005 12*s.*=20112*s.* theſe × by 26 (the third Term)=522912*s.* which ÷ by 46 (the firſt Term) will give 11367*s.* 7¾*d.* $\frac{14}{46}$, or £. 568 7*s.* 7¾*d.* $\frac{1}{46}$ the Anſwer.

```
(14)                   C.     lb.   s.  d.    C. qrs. lb.
     Stated thus—If 1 or 112 : 32   6 :: 12   2   14
     Or, as 112 : 390d. 1414 : 4923¾d.
```

For by Reduction 32*s.* 6*d*=390*d.* and 12 *C.* 2 *qrs.* 14*lb.* =1414*lb.* which × by 390*d.*=551460*d.* theſe ÷ by 112 (the firſt Term) will give 4923¾*d.* or £. 20 10*s.* 3¾*d.* the Anſwer.

(15) Firſt Coſt £. 89 16*s.* 4*d.* Loſt £. 12 Difference; £. 77 16*s.* 4*d.* ſold for—then

```
                       C.     lb.  £.  s.  d.  lb.
     Stated thus—If 1 or 112 : 77  16  4 :: 1
     Or, as 112 : 18676d. :: 1 : 166¾d.
```

For by Reduction £. 77 16*s.* 4*d.*=18676*d.* which ÷ by 112 will give 166¾*d.* or 13*s.* 10¾*d.* the Anſwer.

Or thus, £. 77 16*s.* 4*d.*÷4×7×4(112)=13*s.* 10¾*d.*

(16) Here, as he ſpends as much in 4 Months as he gains in 3, conſequently he will ſpend in 8 Months what he gains in 6———then

```
                M.  £.   s.  d.          £.   s.  d.
Stated thus—If 8 : 185   5   6 :: 12     185  5   6
                             12               ×   2
               ______________           ___________
              8)2223   6   0     Gains   370  11  0 pr. An
               ______________    Spends  277  18  3 ——
       Spends £. 277  18   3            ___________
               ______________    Anſw.    92  12  9
                                        ___________
```

(17) Firſt 4*s.* 6*d.* × by $\overline{12\times6\times6}+8$ (36 *Doz.* 8 *Prs.*) will give 99£. the Value of the 36 Dozen 8 Pair of Stockings; then

```
                  s.  d.  P.   £.
Stated thus—If 1   4 : 1 :: 99
As 4 : 1 :: 5940 : 1485
```

For by Reduction 1*s.* 4*d.* = 4 Four-pences, and 99£. = 5940 ditto, which ÷ by 4 (the firſt Term) will give 1485 Pair; theſe ÷ 12, will give 123 Dozen and 9 Pair, the Anſwer.

(18) Firſt 18*s.* 9*d.* ÷ by 5=3*s.* 9*d.* ſold for per Yard, and 6*s.* 6*d.*÷2=3*s.* 3*d.* coſt per Yard; then from 3*s.* 9*d.* take 3*s.* 3*d.* remains 6*d.* gained per Yard; and he gained as much as 180 Yards coſt; thus, coſt per Yard 3*s.* 3*d.* or 39*d.*; conſequently 39×180=7020*d.* his whole Gain—then

d. *Yd.* *d.*
Stated thus—If 6 : 1 :: 7020
6)7020

Anſwer, 1170 Yards.

(19) *s.* *d.* *Ell.* *qrs.* *£.* *s.*
Stated thus—If 6 6 : 1 or 5 :: 23 8
Or, as 13 : 5 qrs. :: 936 : 360 qrs.

For by Reduction 6*s.* 6*d.*=13 Sixpences, and 23*£.* 8*s.* =936 Ditto, which multiplied by 5 (the ſecond Term) =468 *qrs.* theſe ÷ by 13 (the firſt Term) will give 360 *qrs.* bought; this ÷ 60, (the Quarters contained in 20 Ells. Fl. or 1 Piece) gives 6 Pieces, the Anſwer.

(20) *s.* *d.* *oz.* *dwts.* *£.* *s.* *d.*
Stated thus—If 5 10 : 1 or 20 :: 102 16 6
Or, as, 70 : 20 *dwts.* :: 24678 : 7050$\frac{6}{7}$ *dwts.*

For by Reduction, 5*s.* 10*d.*=70*d.* and *£.* 102 16 6= 24678*d.* which × by 20, (the ſecond Term=493560 *dwts.* theſe ÷ by 7,0 (the firſt Term) gives 7050$\frac{6}{7}$ *dwts.* the Quantity of Silver bought, which, ÷ by 994 *dwts.* (4*lb.* 1*oz.* 14*dwts.*) the Weight of one Ingot, will give 7 Ingots, and 92 *dwts.* or 4 *oz.* 12$\frac{6}{7}$ [illegible]*s.* over, the Anſwer.

(21) *d.* *oz.* *£.* *s.*
Stated thus—If 8$\frac{3}{4}$: 1 :: 426 16
Or, as 35 : 1 :: 409728 : 11706$\frac{18}{35}$ *oz.*

For by Reduction 8$\frac{3}{4}$*d.*=35 *qrs.* and *£.* 426 16*s.*=409728 *qrs.* which ÷ by 5×7 (35,) gives 11706$\frac{18}{35}$ *oz.* theſe ÷ by 16, 28, and 4, will give 6 Par. and 2 *qrs.* 3 *lb.* 10$\frac{1}{35}$ *oz.* over, the Anſwer.

(22) Here, firſt 100 Guineas=105*£.* lays by; then from *£.* 488 5*s.* his yearly Income, take 105*£.* remains, 383*£.* 5*s.* or 7665*s.* what he ſpends per Annum—then

(23) *D.* *s.* *D.* *s.*
Stated thus—As 365 : 7665 :: 1 : 21.

For 7665÷365=21*s.* per Day.

£. *s.* *s.* *d.* *£.* *s.*
Stated thus—If 1 or 20 : 3 9 :: 564 12
Or, as 20 . 45 :: 11292 : 25407*d.*

For by Reduction, 3*s.* 9*d.*=45*d.* and 564*£.* 12*s.*=11292*s.* which × 45*d.* (the ſecond Term)=508140*d.* this, ÷ by 20, (the firſt Term)=25407*d.* theſe, ÷ by 12 and

20, will give £. 105 17*s.* 3*d.* Taxes, which, ſubtracted from his Income, viz. £. 564 12*s.* leaves £. 458 14*s.* 9*d.* his neat Income, the Anſwer.

(24) *s.* *d.* *oz.* *dwt.* £.
Stated thus—If 5 9 ; 1 or 20 :: 200
Or, as 23 ; 20 :: 16000 ; 13913$\frac{1}{23}$ *dwts.*

For by Reduction, 5*s.* 9*d.*=23 Threepences, and 200£.= 16000 Ditto, which × by 20, (the ſecond Term)= 320000 *dwt.* this ÷ by 23 (the firſt Term) gives 13913$\frac{1}{23}$ *dwts.* theſe *dwts.* ÷ by 692, (2*lb.* 10*oz.* 12*dwts.*) the Penny-weights in an Ingot, will give 20 Ingots, and 73 *dwts.* or 3*oz.* 13$\frac{1}{23}$ *dwts.* over the Anſwer.

(25) First 6×6×10×30=10800 Yards in the ſix Packs, then
Yds. £. *s.* *d.* *Yds.*
Stated thus—As 3 : 2 4 3 :: 10800
Or, as 3 : 531*d.* :: 10800 : 1911600*d.*

For by Reduct. £. 2 4*s.* 3*d.*=531 Pence, theſe × by 10800 =5734800*d.* which ÷ by 3, (the firſt Term)=1911600 Pence, or 7965£. the whole coſt him, and 3) 2£. 4*s.* 3*d.* (14*s.* 9*d.* coſt per Yard———

(26) *W.* £. *s.* *W.*
Stated thus—If 16 ; 14 16 :: 52
Or, as 16 : 296*s.* :: 52 :: 962*s.*

By Reduction, £. 14 16*s.*—296*s.* which × 52=15392*s.* theſe ÷ by 16 (viz. 4×4) givs 962*s.* or £. 48 2*s.* the Anſwer.

(27)

	£.	s.
Oxen, each, - -	10	0
Cows, - -	7	0
Calves, - -	1	10
Sheep, - -	0	19
One of each coſt - £.	19	9

£. *s.* of ea. £. *s.*
Stated thus—If 19 9 : 1 : 116 14
20 20
389)2334(6 of each.

(28) £. £. *s.* *d.* £.
Stated thus—If 560 : 374 10 6½ :: 1
Or, as 560 : 359546 *qrs.* :: 1 : 642$\frac{26}{560}$ *qr.*

By Reduction £. 374 10*s.* 6½*d.*=359546 Farthings, which ÷ by 560 (viz. 8×70) gives 642$\frac{2}{56}$ *qrs.* theſe reduced to Shillings, &c. will be 13*s.* 4½*d.* $\frac{26}{560}$ the Anſwer.

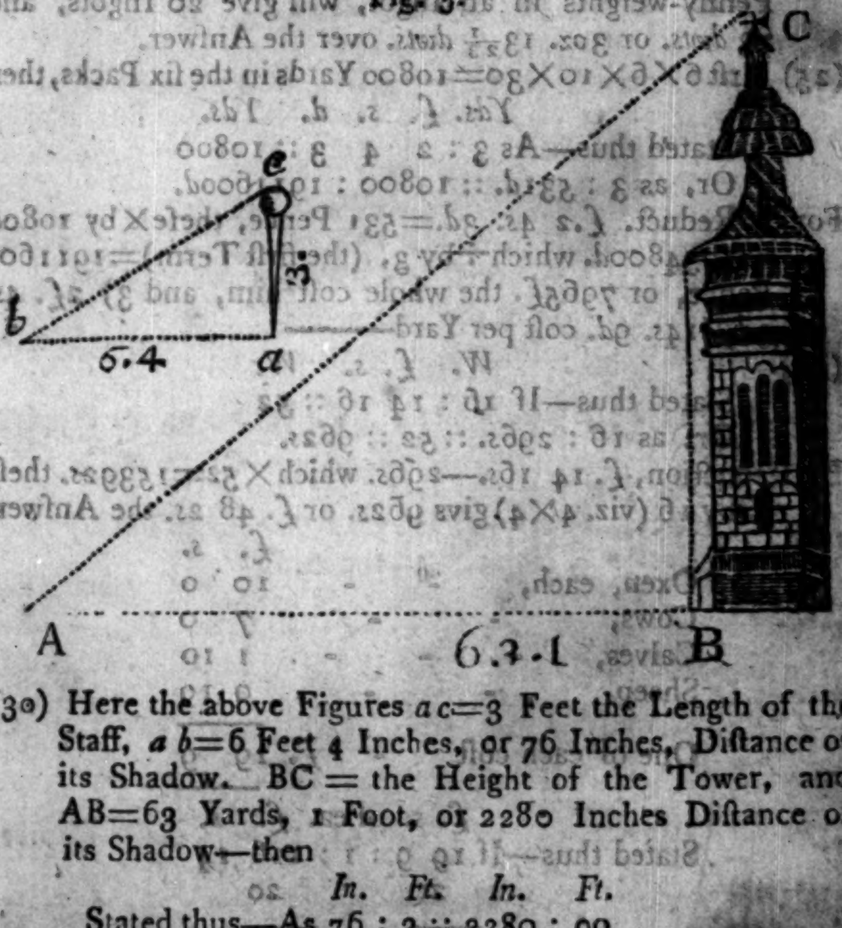
First

(29) Firſt, the Coſt, Cuſtom, Fees, Freight, Factorage, and Profit, added into one Sum=£. 14 0s. 2*d.*—then

C. *qrs.* *lb.* *oz.* £. *s.* *d.* *C.* *lb.*
Stated thus—If 18 3 17 7 : 14 0 2 : 1 or 112
Or. as 33879 : 3362*d.* :: 1792 : $177\frac{3}{4}\frac{10847}{33879}$*d.*

By Reduction 18*C.* 3*qrs.* 17*lb.* 7*oz.*=33879*oz.* and 112*lb.* =1792 *oz.* Alſo 14£. 2*d.*=3362 Pence; then 3362*d.* ×1792 *oz.*=6024704 Pence, which ÷ 33879 (the firſt Term) gives $177\frac{3}{4}$*d.*$\frac{10847}{33879}$, theſe *d.* ÷ by 12, give 14*s.* $9\frac{3}{4}$*d.*$\frac{10847}{33879}$, the Anſwer.

Fig. 5.



(30) Here the above Figures *a c*=3 Feet the Length of the Staff, *a b*=6 Feet 4 Inches, or 76 Inches, Diſtance or its Shadow. BC = the Height of the Tower, and AB=63 Yards, 1 Foot, or 2280 Inches Diſtance of its Shadow—then

In. *Ft.* *In.* *Ft.*
Stated thus—As 76 : 3 :: 2280 : 90

For 2280×3=6840 Feet, which ÷ by 76=90 Feet, the Anſwer. For *a c* : *a b* :: BC : AB.

(31) Stated thus—If 6 4 : 285 :: 1
Or, as 76 : 285 :: 1 : 3 M. 6 Fur.

For 285÷76=(3Miles 6 Fur. the Anſwer.

(32) *Pipe.* *G.* *£.* *s.*

Stated thus—If 1 or 126 : 44 2 :: 1 *Pt.*

Or, as 1008 : 10584*d.* : 1 : $10\frac{1}{2}$*d.*

For 126 Gal. = 1008 Pints and 44£. 2*s.* = 10584 Pence, which ÷ by 1008 (the firſt Term) gives $10\frac{1}{2}$*d.* per Pint, the Anſwer.

(33) Firſt 360×$69\frac{1}{2}$=25020 Miles, the Circumference of the Globe—then

H. *M.* *Miles.* *H.* *M.*

Stated thus—If 23 56 : 25020 :: 1 or 60

60 60

1436)1501200(1045 Miles, 3 Fur. $9\frac{356}{1436}$ Poles, the Anſwer.

(34) *oz.* *dwt.* *£.* *s.* *gr.*

Stated thus—If 1 or 20 : 5 5 :: 1

Or, as 480 : 1260*d.* :: 1 : $2\frac{1}{2}$*d.*$\frac{1}{2}$

By Reduction 20 *dwts.*=480 *grs.* and 5£. 5*s.*=1260 Pence, then 48,0)126,0($2\frac{1}{2}$*d.*$\frac{1}{2}$, the Anſwer.

(35) Firſt 21÷3=7 Half-pence, the Worth of 12 Apples.

Ap. *H.P.* *Ap.*

Stated thus—If 12 : 7 :: 84

Then 84×7=588, which ÷ by 12 (the firſt Term) gives 49 Half-pence, or 2*s.* $0\frac{1}{2}$*d.* the Anſwer.

(36) *s.* *£.* *£.* *s.*

Stated thus—As 4 : 1 :: 8 10

Or, as 4 : 1 :: 170 : £. 42 10*s.* 0*d.*

For 8£. 10*s.* = 170*s.* which ÷ by 4 gives 42£. 10*s.* the Anſwer.

(37) Firſt 184×7×4+$\frac{1}{2}$($28\frac{1}{2}$)=5244 Yards of the former.

Stated thus—As 19 : 14 :: 5244 : 3864

For 5244×14=73416, which ÷ 19=3864 *yds.* the Anſwer.

(38) Firſt 436×117=47502 Pieces; theſe × by 44*d.* (3*s.* 8*d.*) or the Value of one Piece will give 2090088 Pence, Value of all the Pieces—then

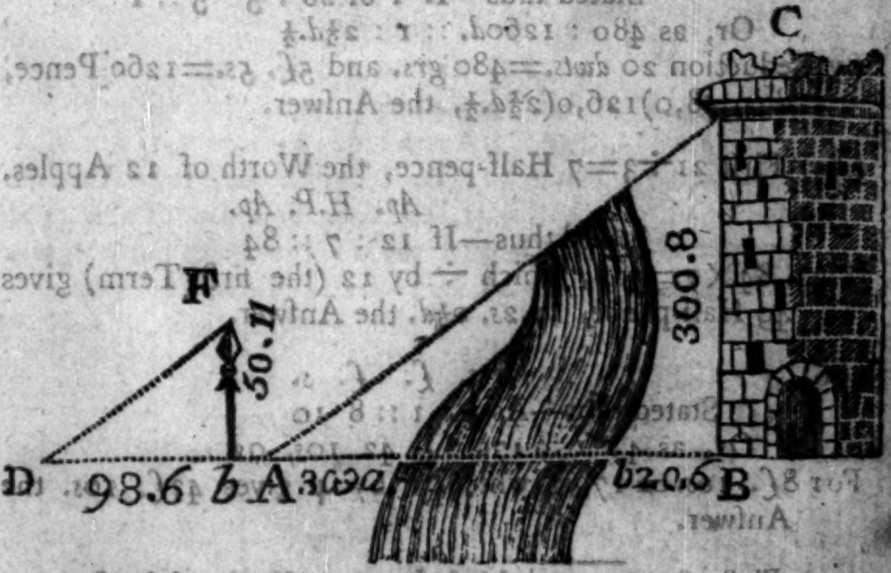
d. *Reas.* *d.*
Stated thus—If 3 : 20 :: 2090088 : 13933920
For 2090088 × 20 ÷ 3 = 13933920 Reas the Anſwer.

(39) Firſt 274 ÷ 4 £. 54 16*s.* coſt him; then—
Ell E. *qrs.* *s.* *d.* *Ell F.*
Stated thus—If 1 or 5 : 7 10 :: 274
Or, as 5 : 94*d.* :: 822 : 15453½*d.*⅖.

By Reduction 7*s.* 10*d.* = 94 Pence, and 274 × 3 = 822 *qrs.* theſe × by 94 = 77268, which ÷ by 5, gives 15453½*d.*⅖ or £. 64 7*s.* 9½*d.*⅖ ſold for.

Then from £. 64 7*s.* 9½*d.*⅖ take £. 54 16*s.* and there will remain £. 9 11*s.* 9½*d.*⅖ gained, the Anſwer.

(40) Fig. 6.



Here F *b* = 50 Feet, 11 Inches, or 611 Inches, Height of the May-Pole, and *D b* = 98 Feet 6 Inches, or 1182 Inches, Length of its Shtdow. Alſo BC = 300 Feet 8 Inches, or 3608 Inches, and AB the Length of its Shadow—then

In. *In.* *In.* *In.*
Stated thus—As 611 : 1182 :: 3608 : 6979
Then $6979 \div 12 = 581\ 7\frac{487}{611}$ = A. B.
And 30 F. 9 In. + 20 F. 6 In. = 51 3 = A *a* + B *b.*
$530\ 4\frac{487}{611}$ = *a b* the

Breadth of the Stream required.

(41) *M. s. M.*
Stated thus—As 2 : 15 :: 7 : 52*s.* 6*d.*

For 15 × 7 = 105*s.* which ÷ by 2 = 52*s.* 6*d.* or £. 2 12*s.* 6*d.* the Anſwer.

(42) *H. M. D. H.*
Stated thus—If 4 : 12 :: 9 : 8
Or, as 4 : 12 :: 116 : 348 Miles.

For 9 D. 8 H. = 116 Hours, which × 12 (the ſecond Term) = 1392 Miles; theſe ÷ 4 (the firſt Term) will give 348 Miles, the Anſwer.

(43) *Yds. s. d. Yds.*
Stated thus—If 5½ : 4 6 :: 1000
Or, as 11 : 54*d.* :: 2000 : $9818\frac{2}{11}$*d.*

By Reduction 5½ Yards = 11 Half Yards, and 1000 Yards = 2000 ditto. Alſo 4*s.* 6*d.* = 54 Pence. Then 54 × 2000 = 108000*d.* which ÷ by 11 (the firſt Term) gives $9818\frac{2}{11}$*d.* or £. 40 18*s.* $2\frac{2}{11}$*d.* the Anſwer.

(44) *s. d. Ell. qrs.* £.
Stated thus—If 5 6 : 1 or 3 :: 352
Or, as 11 : 3 *qrs.* :: 14080 : 3840 *qrs.*

For 5*s.* 6*d.* = 11 Six-pences, and 352£. = 14080 ditto, which × by 3 = 42240 *qrs.* theſe ÷ 11 (the firſt Term) gives 3840 *qrs.* or 960 Yards.

Again, 3840 *qrs.* ÷ 5 = 768 Ells Engliſh, which ÷ by 64 = 12 Ells Engliſh in each Piece.

(45) £. £. *s.* £. *s.*
Stated thus—If 100 : 4 15 :: 40 10
Or, as 2000 : 95*s.* :: 810 : 38*s.* 5½*d.* ⅘

For 100£. = 2000*s.* and £. 4 15*s.* = 95*s.* Alſo £. 40 10*s.* = 810*s.* which × by 95 = 76950*s.* theſe ÷ by 2,000 will give 38*s.* 5½*d.* $\frac{16}{20}$, or £. 1 18*s.* 5½*d.* ⅘, the Anſwer.

(46)

Yds. Yd. Yds. Yds.
(46) Firſt 24×20=480 Yards, contained in the 24 Pieces.
Stated thus—As 12 : 8 :: 480 : 320
Here 480×8=3840 Yards, which ÷ by 12, gives 320 *yds.* the Anſwer.

(47) *A. £. s. d. A.*
Stated thus—If 1 : 1 19 6 :: 240
Or, as 1 : 79 :: 240 : 18960 Sixpences.
By Reduction £.1 19*s.* 6*d.*=79 Sixpences, which × by 4 ×60 (240) the Product is 18960 Sixpences; theſe ÷ by 40, will give 474£. per Annum; this ÷ by 4= £. 118 10*s.* per Quarter, the Anſwer.

(48) *£. s. d. £.*
Stated thus—If 1 : 10 6 :: 1000
Or, as 1 : 21 :: 1000 : 21000 Sixpences.
By Reduction 10*s.* 6*d.*=21 Sixpences, which × by 1000, the Product is 21000 Sixpences, theſe ÷ 40=525£. the Anſwer.

(49) *M. fur. p. ft. Min. Mile. Yds.*
Stated thus—If 37 2 37 $5\frac{1}{2}$: 4 :: 1 or 1760
Or, as 394592 : 4 :: 10560 : $6'' 25\frac{146080}{394592}'''$
By Reduction 37 *m.* 2 *fur.* 37 *p.* $5\frac{1}{2}$ *ft.*=394592 Half-feet, and 1760 Yards=10560 ditto, which × by 4 Minutes (the ſecond Term) the Product will be 42240 Minutes; this × by 60, to bring the Minutes into Seconds, gives 2534400 Seconds; theſe ÷ by 394592 (the firſt Term) the Quotient is $6'' 25\frac{146080}{394592}'''$ paſt 12, the Anſwer.

(50) *£. s. d. E.E. £. s. d.*
Stated thus—If 1 7 10 : 4 :: 118 17 $7\frac{1}{2}$
Or, as 668 : 80 *nails* :: 57063 : $6033\frac{496}{668}$ *nails.*
By Reduction £. 1 7*s.* 10*d.*=668 Halfpence. And £. 118 17*s.* $7\frac{1}{2}$*d.* = 57063 ditto. Alſo 4 Ells Engliſh = 80 Nails, then 57063×80 = 4565040 Nails, which ÷ by 663=$6833\frac{566}{668}$ Nails bought; then to find how many Pieces, each 33 Ells Flemiſh, 1 *qr.* 2 *na.* or 402 Nails, are contained in the Quantity bought; thus, 402)6833(16 Pieces, and 33 *Ells.* 1 *qr.* 1 *na.*$\frac{596}{668}$ over, the Anſwer.

(51) Firſt, from 100£. take 60£. Remains 40£. Serge coſt.
Yds. Y. Yds. Yds.
Stated thus—As 2 : 3 :: 236 : 354

Here 236×3=708; this ÷ by 2=254 Yards of Shalloon, which coſt 60£. conſequently 60£. ÷ by 354, will give 3s. 4½d.$\frac{52}{54}$, what the Shalloon coſt per Yard; and 40£. ÷ by 236, will give 3s. 4½d.$\frac{42}{59}$, what the Serge coſt per Yard.

(52) s. lb. £. s. d.

Stated thus—If 14 : 8 :: 4 19 1¼.

Or, as 672 : 8 :: 4757 : 56lb. 10.1$\frac{352}{679}$

By Reduction 14s.=672 Farthings, and £. 4 19s. 1¼d.= 4757 Ditto, which × by 8, (the ſecond Term) the Product will be 38056; this, ÷ by 672 (the firſt Term) will give 56 lb. 10 oz. 1 dr.$\frac{11}{84}$ the Anſwer.

(53) C. lb. s. C. qrs. lb.

Stated thus—If 1 or 112 : 7 :: 20 2 16

Or, as 112 : 7 :: 2312 : 144s. 6d.

For 20 C. 2 qrs. 16 lb. = 2312 lb. theſe × 7s. = 16184s. which ÷ by 112 will give 144s. 6d. or £. 7 4s. 6d. the Anſwer.

(54) A Pipe = 126 Gallons, from which take 12 Gallons. Remains 114 Gallons, or 456 Quarts, at 18d. per Qr. Then

Qt. d. Qts. d.

Stated thus—As 1 : 18 :: 456 : 8208

Here 456×18=8208 Pence, which, ÷ by 12 and 20, gives £.34 4s. ſold for, from which take £.25 4s. Remains 9£. gained, the Anſwer.

(55) C. qrs. lb. £. s. d. lb.

Stated thus —If 20 2 16 : 7 4 9 :: 1

Or, as 2312 : 6948 qrs. :: 1 : ¾ qrs.

Here by Reduction 20 C. 2 qrs. 16 lb.=2312lb. and £.7 4s. 9d.=6948 Farthings, which ÷ by 2312 (the firſt Term) gives ¾ $\frac{12}{2312}$, the Anſwer.

(56) Firſt 9×4=36 ſquare Inches in one Brick, and 20×20 =400 Feet ſqare, in the Floor, which × by 144=57600 ſquare Inches, the Content of Ditto.—Then

Inch. B. Inch.

Stated thus—As 36 : 1 :: 57600 : 1600

For 57600÷6×6(36)=1600 Bricks, the Anſwer.

(57) Firſt 22×4=88 Miles, I have gone before you ſet out, and 32—22=10——you gain upon me per Day; then

Stated thus—As 10 : 1 :: 88 : 8$\frac{4}{5}$

For 88÷10=8$\frac{4}{5}$ Days, before you overtake me.

Then 8$\frac{4}{5}$×4×8(32)=281$\frac{3}{5}$ Miles, you travelled before I was overtaken, conſequently 350—281$\frac{3}{5}$=68$\frac{2}{5}$ Miles on this Side Edinburgh, the Anſwer.

(58) Firſt, from 20 take 11. Remains 9 Days to be ſunk.

Days. Yea. Days.

Then ſtated thus—As 3 : 400 :: 9 : 1200

Here 400×9=3600; this÷by 3=1200 Years after Anno 1700; then 1200 added to 1700=2900, the Year of Chriſt required.

(59) *d. lb. d.*

Firſt, Beef coſt per Day, 2$\frac{1}{4}$×5=11$\frac{1}{4}$, and per Week, 11$\frac{1}{4}$d. ×7=6*s.* 6$\frac{3}{4}$*d.*=315 *qrs.*

Biſcuit coſt per Day, 1$\frac{1}{2}$*d.*×3*lb.*=4$\frac{1}{2}$*d.* and per Week, 4$\frac{1}{2}$*d.* ×7=2*s.* 7$\frac{1}{2}$*d.*=126 *qrs.*

Meat for the Ship's Company coſt per Day £. 12 12*s.* and per Week £.12 12*s.*×7=£.88 4*s.* or 84672 Farthings.

Stated thus—If 315 : 126 :: 84672 : 33868$\frac{252}{315}$ *qrs.*

For 84672×126=10668672, which÷by 315=33868$\frac{252}{315}$*qrs.* or £.35 5*s.* 7—*d.*$\frac{252}{315}$.

(60) *H. M. H.*

Stated thus—As 8 : 135 :: 1 : 16*m.* 7*fur.*

Here 135÷8=16 Miles 7 Furlongs, what both rode per Hour.

M. fur. p. M. f. M. fur. p.
Then, 16 7 0 leſs 2 4=14 3 0
And, 14 3 0÷by 2 = 7 1 20 B. rode per Hour.
Alſo, 7 1 20+ 2 4=9 5 20 A. ditto.

M. fu. p. *M. fur.*
For {7 1 20 / 9 5 20} × by 8= {57 4B. / 77 4A.} travelled.

Proof, 135 Miles.

(61) Suppoſe 130 to be the whole Work; then A. will perform $\frac{1}{13}$th Part, and B. $\frac{1}{10}$th, which will be 13+to =23*d*. Part of the Work performed by them both together in one Day.

W. Day. W. D. H. M.

Then ſtated thus—As 23 : 1 :: 130 : 5. 7.49$\frac{13}{23}$

For 130÷23=5Days, 7 Hours, 49$\frac{13}{23}$ Minutes, the Anſwer.

(62) Here, ſuppoſe 198 to be the whole Work, of which B. and C. will perform $\frac{1}{18}$, viz. 11, and with the Help of A. they will perform $\frac{1}{11}$, viz. the 18th Part in one Day, then 18—11=7th Part performed by A. alone.

Then ſtated thus—If 7 : 1 :: 198

7)198(28 Days, 3 H. 25$\frac{5}{7}$ M. the Anſ.

To perform Queſtions of this Nature, you may ſuppoſe any Number to be the Work, ſo that it will divide by the different Times the different Perſons Perform the Work in: thus, in the 61ſt Queſtion I ſuppoſed 130, by Reaſon it will divide by 13 and by 10, and nothing Remains. Likewiſe in the laſt Queſtion I ſuppoſed 198, as it will divide by 18 and 11, and leaves nothing remaining.

£. £. £. £. *s.* *d.*

(63) Stated thus—As 17 : 3 :: 140 : 24 14 1$\frac{1}{4}$ $\frac{11}{17}$

£. £. *s.* *d.*

Here 140×3=420; this÷by 17=24 14 1$\frac{1}{4}\frac{11}{17}$ taken off, Then from £. 140 take £. 24 14*s.* 1$\frac{1}{4}$*d.* $\frac{11}{17}$. Remains £. 115 5*s.* 10$\frac{3}{4}$*d.* $\frac{6}{17}$, the Aſſeſſment, which ÷ by 5, gives £. 23 1*s.* 2*d.*—$\frac{8}{17}$ the Taxes; this, taken from £. 140, leaves £. 116 18*s.* 9$\frac{3}{4}$*d.* $\frac{9}{17}$, the Anſwer.

(64) £. £.

$$\text{Firſt } 1000 \div \text{by} \begin{cases} 5=200 \text{ gained by Land Trade,} \\ 8=125 \text{ Sea ditto.} \end{cases}$$

Sum, 325 Gain per Year.

Then $1000 \div 2\frac{1}{2} = 400$ £. loſt in 1 Year.

And 400 £. $-\,395 = 75$ £. run out per Year.

£. Y. £.

Stated thus—As $75 : 1 :: 1000 : 13\frac{1}{3}$

For $1000 \div 75 = 13\frac{1}{3}$ Years, the Anſwer.

(65) Here, from 10 in the Morning till 6 in the Evening is 8 Hours.—I ſet out before you, then $2 \times 8 = 16$ Miles I travelled before you ſet out, and $170 - 16 = 154$ Miles; Alſo, $2 + 3 = 5$ Miles both travelled per Hour.

M. H. M.

Stated thus—As $5 : 1 :: 154 : 30\frac{4}{5}$

For $154 \div 5 = 30\frac{4}{5}$ Hours they will meet.

Then $30\frac{4}{5} \times 2 = 61\frac{3}{5}$, which added to $16 = 77\frac{3}{5}$ Miles, or 77 *m.* 4 *fur.* 32 *p.* from Exeter; and $30\frac{4}{5} \times 3 = 92\frac{2}{5}$ M. or 92 *m.* 3 *fur.* 8 *p.* from London.

$$\text{Anſwer,}\ \left\{\begin{array}{lll} 77 & 4 & 32 \\ 92 & 3 & 8 \end{array}\right\}\ \text{diſtance from}\ \left\}\begin{array}{l} \text{Exeter;} \\ \text{London.} \end{array}\right.$$

Proof, 170 Miles.

(66) Firſt, from 13° take 1°, remains 12°, Moon gains of the Sun per Day.

And $30° + 3 = 90°$, from the firſt of Aries to the firſt of Cancer.

Alſo, $90° + 3 = 93°$ Sun before the Moon.

Then ſtated thus—As $12° : 1 :: 93° : 7\frac{3}{4}$

D.

For $93 \div 12 = 7\frac{3}{4}$ Days, in which Time the Sun will be overtaken by the Moon.

$\therefore 7\frac{3}{4} + 3 = 10\frac{3}{4}$ Degrees of Cancer, the Anſwer.

(67) Firſt, from 21 take 15. Remains 6 Rods, the Dogs gained in running 21 Rods, and fourſcore $= 80 + 16 =$ 96 Rods the Hare ſtarted before the Dogs.—Then

R. R. R.

Stated thus—As $6 : 21 :: 96 : 336$

Here $96 \times 21 = 2016$; this $\div$ by 6, gives 336 Rods the Dogs ran, and $336 - 96 = 240$ Rods the Hare ran.

(68)

(68) Firſt, $5\frac{2}{3}$ Miles=29920 Feet.

Feet. Sec. Feet.

Stated thus—As 1150 : 1 :: 29920 : 26 1$\frac{1}{23}$

For 2992,2÷115,0 26 Sec. 1$\frac{1}{23}$ Third, the Anſwer.

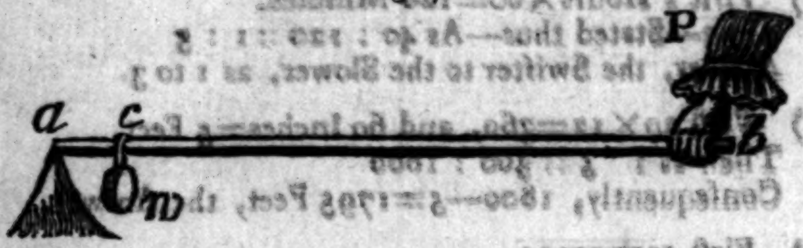
(69) Firſt, 1 Min. 3 Seconds=63 Seconds.

″ *Feet.* ‴

Stated thus—As 1 : 1150 :: 63 : 72450

For 1150×63=72450 Feet, or 13 Miles, 5 Furlongs, 30 Poles, 5 Yards, the Anſwer.

Fig. 7.



(70) Here *a b*=100 Inches, and *a c*=7½, P the Power, or 168*lb.* and *w.* the Weight to be moved.

Then from 100 take 7½, remains 92½=*a b*—*a c*=*c′b*.

In. lb. In.

Stated thus—If 7½ : 168 :: 92½ : 2072

Or as 15 : 168 :: 185 : 2072.

Here 7½ Inches=15 Half Inches, and 92½=185 Half Inches, which×168=31080 *lb.* theſe÷by 15=2072 *lb.* =*w.* the Anſwer.

For A's *a c* : P :: *c b* : *w*.

(71) Firſt, 9×2=18 Inches the Diameter of the Crank.

Ft. In. Ft.

Stated thus—As 6 : 18 :: 9 : 27

For $\overline{18\times9}\div6=162\div6=27$ Inches the Anſwer.

(72)

(72) Firſt $62\frac{1}{2}\times 3=187\frac{1}{2}$*lb.* Wt. of Three ſolid Feet of Water.

Feet. *lb.* *Feet.*

Therefore, Stated thus—As $6 : 187\frac{1}{2} :: 9 : 281\frac{1}{4}$

For $187\times 9\div 6=1687\frac{1}{2}\div 6=281\frac{1}{4}$*lb.* the Anſwer.

(73) Stated thus—As 25 : 1000 :: 1 : 40, ſo the leſs is moved with a Force 40 Times greater than the other.

(74) Stated thus—As $60 : 8 :: 100 : 13\frac{1}{3}$

Anſw. as $13\frac{1}{3}$ to 1.

(75) Stated thus—As 8 : 48 :: 1 : 6

Anſwer, Leſſer to the Greater as 1 to 6.

(76) Firſt 2 Hours×60=120 Minutes.

Then—Stated thus—As 40 : 120 :: 1 : 3

Anſwer, the Swifter to the Slower, as 1 to 3.

(77) Firſt 30×12=360, and 60 Inches=5 Feet.

Then as 1 : 5 :: 360 : 1800

Conſequently, 1800—5=1795 Feet, the Anſwer.

(78) Firſt 50÷5=10

Then—Stated thus—As 5 : 10 :: 1 : 2

So that the firſt Body hath been in Motion double the Time of the latter.

(13) THE RULE OF THREE INVERSE.

(1)

D. *M.* *D.*

Stated thus—If 12 : 48 :: 72

12

$$72\begin{cases}9)576\\ 8)\ 64\end{cases}$$

8

Anſwer, 8 Men.

D. *M.* *D.*

If 72 : 8 :: 12

72

12)576

Proof 48 Men.

(2) *In.B. In.L. In. B.*

Stated thus—As 12 : 12 :: 4 : 36

Here 12×12=144; this÷4=36 Inches long, the Anſwer.

(3) *£. M. £.*

Stated thus—As 500 : 6 :: 220 : 13*m.* $19\frac{1}{11}$

Here 500×6=3000, this÷by 220, gives 13 Months, $19\frac{1}{11}$ Days, the Anſwer.

(4) *M. oz. M.*

Stated thus—As 3 : 14 :: 8 5 *oz.* 5 *dwts.*

Here 3×14=42, this÷by 8=5 *oz.* 5 *dwts.* the Anſwer.

(5) *s. d. oz. s.*

Stated thus—If 4 6 : 12 :: 3

Or, as 9 : 12 : 6 : 18 *oz.*

Here 4*s.* 6*d.*=9 Sixpences, and 3*s.*=6 do. then 12×9=108; this÷by 6, the laſt Term, gives 18 *oz.* the Anſwer.

(6) *Qrs. Yds. Qrs.*

Stated thus—If 5 : 275 :: 3

Here 275×5=1375, this÷by 3, gives 458 *yds.* 1 *qr.* $1\frac{1}{3}$ *na.* the Anſwer.

(7) *£. Yrs. £.*

Stated thus—As 80 : 15 :: 600 : 2

Here 15×80=12,00, this÷by 6,00, gives 2 Years, the Anſwer.

(8) *M. W. D. M.*

Stated thus—If 10 : 43 5 :: 6

Or, as 10 : 306 :: 6 : 510

Here 43 *w.* 5 *d.*=306 Days, which×by 10=3060, this÷by 6, gives 510 Days, or 18 Months 6 Days, the Anſwer.

(9) Firſt 3 *qrs.*=$2\frac{1}{4}$ *Feet.* Then,

Ft. Ft. F.

Stated thus—If 24 : 30 :: $2\frac{1}{4}$

Or, as 96 : 30 :: 9 : 320

Here 24 *ft.*=96 *qrs.* and $2\frac{1}{4}$=9 *qrs.* then 96×30 (the ſecond Term)=2880 Feet; theſe÷by 9 (the laſt Term) gives 320 Feet=$106\frac{2}{3}$ Yards, the Anſwer.

Note. Paper is 27 Inches, or $2\frac{1}{4}$ Feet wide.

(10) *Mo. Men. Mo.*

Stated thus—As 3 : 1500 :: 5 : 900

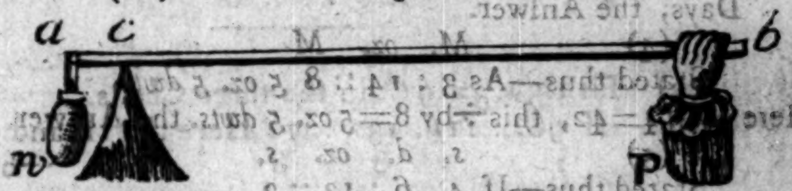
Here 1500×3=4500, this÷by 5, gives 900 Men, to continue in; then from 1500 take 900, remains 600 Men to depart.

(11) *H.Cock. M.*

Stated thus—As 6 : 1 :: 15 : 24

Here 6 Hours × 60 = 360 Minutes, which ÷ by 15, (the laſt Term) gives 24 Cocks, the Anſwer.

(12) Fig. 8.



In the above Figure $ab = 100$ Inches, $ac = 7\frac{1}{2}$, P the Power, or $1\frac{1}{2}$ *Cwt.* and *w.* the Weight.

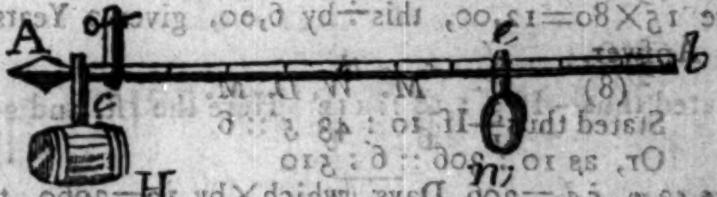
Then $100 - 7\frac{1}{2} = 92\frac{1}{2}$ Inches $= ab - ac = cb$.

Stated thus—As $92\frac{1}{2}$: $1\frac{1}{2}$*C.* or 168*lb.* :: $7\frac{1}{2}$

Here $92\frac{1}{2} = 185$ half Inches, and $7\frac{1}{2} = 15$; then $185 \times 168 = 31080$; this ÷ by 15, (the laſt Term) gives 2072*lb.* or $18\frac{1}{2}$*C.* the Anſwer.

For as *b c* : *w* :: *a c* : P.

(13) Fig. 9.



In the above Fig. *c e* = 70 Inches, *Ac* = 2, H the Hogſhead, and *w* the Weight.

In. C. *In.*

Stated thus—As 2 : $9\frac{1}{2}$ :: 70

Or, as 2 : 1064*lb.* :: 70 : 30*lb.* 6*oz.* $6\frac{28}{70}$*drs.*

Here $9\frac{1}{2}$*C* = 1064*lb.* which × by 2 = 2128*lb.* theſe ÷ by 70, (the laſt Term) gives 30*lb.* 6*oz.* $6\frac{28}{70}$*drs.* the Weight required.

For as *Ac* : *w* :: *ec* : H.

(14) Stated thus—As 100000 : 20 :: 30 : 66666 Feet, 8 Inches per Second, the Anſwer.

(15) *lb.* *Feet.* *lb.*
Stated thus—As 200 : 100 :: 8 : 2500 Feet per Second.

(14) CONTRACTIONS *in the* RULE *of* THREE.

Yds. £. *s.* *d.* *Yds.*
(1) Stated thus—If 4 : 3 17 6 :: 28 Here the firſt
× 7 7 and Second
[Term ÷ by 4.
Anſwer, £. 27 2 6

(2) Firſt 3 × 3 = 9 C. in the three Cheſts.
Stated thus—If 9 C. : 11 £. 13*s*. :: 72 Here the 1ſt and 3d.
1 8 8 ÷ by 9
Anſwer, £. 93 4 0

(3) C. £. C.
Stated thus—If 26 : 78 :: 156 Here 1ſt. and 2d. ÷ by 26.
1 3 3
£. 468 the Anſwer.

(4) *lb.* *s.* *lb.*
Stated thus—If 3 : 18 :: 112 Here the 1ſt, and 2d. ÷
1 6 6 [by 3.
Anſwer, £. 33 12*s*. 0*d*.

(5) Firſt 6×8=48 Yards in the 6 Gowns.
Yds. £. *Yds.*
Then—Stated thus—If 48 : 6 :: 64 Here the 1ſt. and 2d. ÷
8)64(8 £. the Anſwer. [by 6.

(6) Firſt, 1½ C. = 168 *lb.*
lb. *s.* *lb.* [12.
Then—Stated thus—If 24 : 12 :: 168 Here 1ſt. and 2d. ÷
2)168(84*s*. or 4 £. 4*s*. Anſwer.

(7)

(7) First 24×3=72 Yards in the 3 Pieces.

Yds. £. *s.* *Yds.*

Then—If 72 : 64 14 :: 8 Here 1ſt. and 3d. ÷ by 8.

9)64 14(7£. 3*s.* $9\frac{1}{4}$*d.* $\frac{1}{3}$ Anſwer.

(8) First 6×3=18*lb.* in the 6 Parcels.

lb. £. *s.* *lb.*

Then—If 18 : 12 19 :: 6 Here 1ſt. & 3d. Terms ÷ by 6.

3)12 19(£. 4 6*s.* 4*d.* the Anſwer.

(9) Stated thus—If 12 : 12 :: 3 Here the 1ſt. and 3d. ÷ by 3.

In. *In.* *In.*

4 4 1

Anſwer, 48 Inches, or 4 Feet.

(10) Stated thus—If 512 : 225 :: 64 Here 1ſt. and 3d. ÷ by 64.

M. C. M.

8 8 1

Anſwer, 1800 *Cwt.*

(15) THE RULE OF FIVE:

OR,

THE DOUBLE RULE OF THREE.

(1) Placed thus, 6 : 12 : 72

P. D. A.

4 120

Now, per Rule 5th, 72×4=288 Diviſor

And, 12×6×120=8640 Dividend.

Then, 8640÷288=30 Men, Anſwer.

By two Statings, First, As 12 : 6 :: 4 : 18

Second, As 72 : 18 :: 120 : 30 Men, as before.

(2) Placed thus—6 : 12 : 2, Then 6×12=72, the Diviſor.

P. D. B.

36 : 4 :—, And 36×4×2=288 the Dividend.

So 288÷by 72=4 Buſhels, Anſwer.

By two Statings, First, As 6 : 2 :: 36 : 12

Second, As 12 : 12 :: 4 : 4 Bu.

(3) P. w. £. Now 21×6=126 the Diviſor.
6 : 21 : 120 And 46×14×120=77280£. Divid.
14 46 ——. Then 77280÷126=£.613 6s. 8d. the Anſwer.
By two Statings, Firſt, As, 6 : 120 :: 14 : 280.
Second, As, 21 : 280 :: 46 : £.613 6s. 8d.

(4) Here £.9 5s.=8880 Farthings, and £.70 10s. $3\frac{1}{4}$d.=67695 ditto.
C. C. qrs. Then 8880×125=1110000 the Diviſor.
40 : 100 : 8880 And 67695×40×100=270780000 Div.
— : 125 67695 So 27078,0000÷111,0000=243C. 3qrs. 21lb. 15oz. $2\frac{18}{111}$drs.
By two Statings, Firſt, A.'s 100 : 40 :: 125 : 32.
Second, As 8880 : 32 :: 67995 : 243C. 3qrs. 21lb. 15oz. $2\frac{18}{111}$drs.

(5) Firſt, from £.125 8s. take 120£. Remains 5£. 8s. or 108s. Intereſt.
£. M. s. Then 120×9=1080 the Diviſor.
120 : 9 : 108 And 108×12×100=129600s. Dividend.
100 12 : —. Therefore 12960,0÷108,0=120s. or 6£. the Anſwer.
By two Statings, Firſt, 9 : 108 :: 12 : 144s.
Second, As, 120 : 144 :: 100 : 120 .=6£.

(6) Firſt. 100£.=24000 Pence, and £.259 13s. 5d.=62321do. then
D. W. £. Here 52×24000=1248000 the Diviſor.
24000 : 52 : 5 And 62321×5×20=6232100 Dividend.
62321 : 20 : - Therefore 62321,00÷12480,00=£4 19s. $10\frac{1}{4}$d.$\frac{1056}{1248}$ the Anſwer.
W. W. £. s. d.
By two Statings, Firſt, As, 52 : 5 :: 20 : 1 18 $5\frac{1}{2}\frac{2}{13}$.
Second, As, 24000d. 38s. $5\frac{1}{2}$d.$\frac{2}{13}$ :: 62321.
£.4 19s. $10\frac{1}{4}$d.$\frac{10}{13}$, as before.

(7) Firſt 20 Weeks=5 Months. Then
1400 : 5 : 14. Here 14×8=112 Diviſor.
—— : 8 : 8. And 1400×5×8=56000 Divid.
Therefore 56000÷112=500 Men.
By two Statings, Firſt, As, 5 : 1400 : 8 : 875.
Second, As, 14 : 875 :: 8 : 500 Men.

(8) Firſt, 10 Guineas=210 Shillings, and 5£.=100s. then
M. D. s. Here 100×12=1200 the Diviſor.
8 : 5 :: 100 And 210×8×5=8400 the Dividend.
— : 12 : 210 Therefore 84,00÷12,00=7 Men, the Anſ.
By two Statings, Firſt, As, 5 : 8 :: 12 : $3\frac{1}{3}$.
Second, As, 100 : $3\frac{1}{3}$ :: 210 : 7 Men.

(9) Firſt, 24 Weeks, 4 Days=172 Days; then
M. D. £. Here 140×12=1680 the Diviſor.
5 : 172 : 140 And 172×5×200=172000 the Dividend.
12 : —— : 200 Therefore 17200,0÷168,0=$102\frac{64}{168}$ Days
or 3 *Mo.* 2 *W.* $4\frac{64}{168}$ *D.* the Anſwer.
By two Statings, Firſt, As, 5 : 172 :: 12 : $71\frac{2}{3}$.
Second, As, 140 : $71\frac{2}{3}$ :: 200 : $102\frac{2}{7}$ *D.* or 3 *Mo.* 2 *W.* $4\frac{2}{7}$ *D.*

(10) Firſt, 3£. 10s.=70s. and 38£. 10s.=770s. Alſo 1 Year=4*qrs.* and $1\frac{1}{4}$=5 *qrs.*
£. *qrs. s.* Here 70×5=350 the Diviſor.
100 : 4 : 70 And 770×4×100=308000 the Dividend.
—— : 5 : 770 Therefore 30800,0÷35,0=880£. Anſwer.
By two Statings, Firſt, As, £.4 : 100£. :: 5 : 87*s.* 6*d.* 1050*d.*
Second, As, 70 : 1050*d.* :: 770 : 211200*d.*=880£.

(11) Firſt, 36*s.*÷by 12 (the Sacks in a Chaldron)=3*s.* what the Coals coſt per Week, and 41£.=820*s.* then
P. w. s. Here 3×6=18 the Diviſor.
7 : 1 : 3 And 820×7=5740 the Dividend.
– : 6 : 820 Therefore 5740÷18=$318\frac{8}{9}$ Poor, the Anſwer.
By two Statings, As, 1 : 7 :: 6 : $1\frac{1}{6}$.
Second, As, 3 : $1\frac{1}{6}$ :: 820 : $318\frac{8}{9}$ Poor.

(12) Firſt, As, 2 : 11 :: 3 : $16\frac{1}{2}$ A. goes, while B. goes 17.
Then 17−$16\frac{1}{2}$=$\frac{1}{2}$ Toiſe B. gains of A. in going 17 Toiſes. —Again.
As $\frac{1}{2}$: 17 :: $\frac{1}{2}$: 17 Times round gone by A. and $16\frac{1}{2}$ by B. the Anſwer.

(13) Firſt 18 × 2 = 36 Inches, Length of the Leaver; then
In. *Ft.* *In.* *Ft.*
Stated thus—As 40 : 104 :: 36 : $93\frac{3}{5}$.
Feet. *Hou.* *Feet.*
Again, — As $93\frac{3}{5}$: 1 :: 73 : 10 Hours, 8 Min. 20 Sec. the Anſwer.

In. *lb.* *In.* *lb.*
(14) Stated thus—As 1 : $1\frac{1}{2}$ :: 12 : 18wt. 12 In. } from the
Again, — As 1 : $1\frac{1}{2}$ :: 28 : 42wt. 28 — } Shoulders
Conſequently 42 — 18 = 24*lb.* the Anſwer.

(15) Firſt, 30 Inches = $2\frac{1}{2}$ Feet, 24 = 2 ditto, and 4C. 70*lb.* = 518*lb.* then 11 — $2\frac{1}{2}$ = $8\frac{1}{2}$ Feet; alſo 11 — 2 = 9
Feet. *lb.* *Feet.* *lb.* [mer Caſe.
Stated thus—As 11 : 518 :: $8\frac{1}{2}$: $400\frac{3}{11}$ Force in the for-
And Contra, As $8\frac{1}{2}$: $400\frac{3}{11}$ :: $2\frac{1}{2}$: $117\frac{8}{11}$ Preſſure.
Again, As 11 : 518 :: 9 : $423\frac{9}{11}$ Force in lat. Ca.
Alſo, As 9 : $425\frac{9}{11}$ :: 2 : $94\frac{2}{11}$ Preſſure.

H. *D.* *H.* *D.*
(16) Stated thus—As 12 : 7 :: 16 : $5\frac{1}{4}$ of 16 Hours each.
M. *D.* *M.* *D.* *H.* *M.*
Then, As 152 : $5\frac{1}{4}$ :: 576 : 19 14 $18\frac{114}{152}$, the Anſwer.

M. *Gall.* *M.* *Gall.*
(17) Stated thus—As 9 : 14 :: 31 : $48\frac{2}{9}$ fills in 31 Minutes.
Then $48\frac{2}{9}$ — 40 = $8\frac{2}{9}$ Gallons in the Tub at the End of 31 Minutes.
And from 2 to 5 = 3 Hours, or 180 Minutes.
M. *gal.* *M.* *gal.*
Again, As 31 : $8\frac{2}{9}$ :: 180 : $47\frac{23}{31}$ fills in 3 Hours.
And, 147 — $47\frac{23}{31}$ = $99\frac{8}{31}$ Gallons wants of being full.
gal. *M.* *gal.* *M.* *ſec.*
Alſo, As 14 : 9 :: $99\frac{8}{31}$: 63 $48\frac{1428}{6734}$, the Tub will be full.
Which added to 5 o'Clock, will give 3 Min. $48\frac{1428}{6734}$ Sc. after 6, the Tub will be full.

(18) Firſt $1\frac{1}{2}$*d.* = 3 Halfpence, and 6*s.* $7\frac{1}{2}$*d.* = 159, Ditto.
£. *£.*
Stated thus—As 3 : 1 :: 159 : 53 = $\frac{4}{5}$ of the Rent.
Then 53*£.* ÷ 4 = 13*£.* 5*s.* = $\frac{1}{5}$ of the Rent, the Anſwer.
For 53*£.* added to 13*£.* 5*s.* gives 66*£.* 5*s.* the whole Rent.

£. £. *s.* £. *s.*

Again, As 1 : 4 :: 66 5, 265 or 13 5 the Anſwer.

Or, inſtead of the laſt Stating, thus; from £.66 5*s.* the whole Rent, take $\frac{4}{5}$, viz. 53£. Remains £.13 5*s.* the King's Tax, as before.

(19) Firſt, 45 + 13 = 58 Perſons, and 17 Guineas = 375 Shillings.

P. £. *P.*

Stated thus—As 45 : 20 :: 58 : $25\frac{7}{9}$£. in the ſame Time.— And in twice that Time the 58 Perſons will ſpend $25\frac{7}{9}$ × 2 = $51\frac{5}{9}$£'s Worth, at 17 Guineas per Head.

Then—As $51\frac{5}{9}$: 17 or 357 :: 63 : 436 24, $\frac{416}{464}$ = £.11 16*s.* $2\frac{3}{4}$*d.* $\frac{2716}{2964}$ per Hhd. which × by 2 = £. 23 12*s.* $5\frac{1}{2}$*d.* $\frac{2568}{2964}$ per Pipe, the Anſwer.

(20) Firſt 8 − 5 = 3 Miles B. } gained of A. in one Day.
And 10 − 5 = 5 —— C. }

M. *D.* *M.* *D.*

Then Stated thus—As 3 : 1 :: 73 : $24\frac{1}{3}$ when A and B meet.
Again, As 5 : 1 :: 73 : $14\frac{3}{5}$ —— A and C ——.

So that B nor C can never meet with A but at the End of theſe Periods, when A and C will have travelled 219 Miles.

D. *D.* *D.* *M.*

∴ Then, As $14\frac{3}{5}$: 219 :: $24\frac{1}{3}$: 365.

219 } × by { $24\frac{1}{3}$
465 } { $14\frac{3}{5}$ } = 5329 Days, the 73d Time of their general Meeting. ∴ 5329 ÷ 73 = 73 Days, their firſt general Meeting.

$$\begin{array}{c}
 & M. & D. & & M. & \\
\text{For As } & 73 & \left|\begin{array}{c}24\frac{1}{3}\\14\frac{3}{5}\end{array}\right| & :: & \left|\begin{array}{c}219\\365\end{array}\right| & : 3 \text{ Days.}
\end{array}$$

(21) Firſt, for every Day he worked he received 12 Pence.
And for every Day he played he paid 8 ——

Sum, 20

Likewiſe, as his idle Days came to the ſame Money as thoſe he worked, therefore the Proportion will be as follows:

D. *D.* *D.*

As 20 : 390 :: 8 : 156 Days he worked.

And As, 20 : 390 :: 12 : 234 —— played.

For 156, at 12*d.* per Day, comes to the ſame Money as 234 at 8*d.* per Day, viz. £.7 17*s.* the Proof.

(22)

(22) Firſt, fourſcore and eleven, or 91 Guineas=5733 Four-pences.

And from December 11, to May 20th=150 Days.

Alſo, 100 Marks=4000 Four-pences.

And from September 3d. to Chriſtmas=113 Days.

Then Stated thus—As 5733 : 150 :: 4000 : $214\frac{395}{400}$, or rather 215 Days, from which take 113=102 Days, and £.40=2400 Four-pences.

Again, Recep. As 4000 : 102 :: 2400 : 170 Days, the Anſwer nearly.

(23) Firſt £.2 1*s.* 8*d.*=500 Pence, and 500÷20=25 Days Wages; then 40—25=15 Days more.

For every Day he worked he had — 20 Pence.

And for every Day he played, — 10

Sum 30

d. *D.* *d.* *D.*

Then—As 30 : 15 :: $\begin{cases} 10 : 5 \text{ worked.} \\ 20 : 10 \text{ idle.} \end{cases}$

∴ He was idle 10 Days and worked (5+25)=30 Days.

(16) PRACTICE.

(1)

$\frac{1}{4}$ | $\frac{1}{4}$ | 2107 at $\frac{1}{4}$*d.*

12 | $526\frac{3}{4}$

2,0 | 4,3 10

£.2 3 $10\frac{3}{4}$

(2)

$\frac{1}{2}$ | $\frac{1}{2}$ | 1470 at $\frac{1}{2}$*d.*

12 | 735

2,0 | 6,1 3

£.3 1 2

(3)

(3) ½ | ½ | 1276 at ¾*d.*
¼ | ½ | 638
319
12 | 957
2,0 | 79 9
£. 3 19 9

(4) 12)1762 at 1*d.*
2,0) 146 10
£. 7 6 10

(5) ¼ | ¼ | 1400 at 1¼*d.*
350
12 | 1750
2,0 | 145 10
£. 7 5 10

d.
(6) 1½ | ⅛ | 2462 at 1½*d.*
2,0 | 307 9
£. 15 7 9

(7) 1½ | ⅛ | 1041 at 1¼*d.*
¼ | ⅙ | 130 1
21 8¼
2,0 | 151 9¼
£. 7 11 9¼

(8) 2 | ⅙ | 2490 at 2*d.*
2,0 | 41,5
£. 20 15

(9)

d.
(9) 2 | ⅙ | 2408 at 2¼
¼ | ⅛ | 401 4
50 2
2,0 | 45,1 6
£.22 11 6

d.
(10) 2 | ⅙ | 640 at 2½d.
½ | ¼ | 106 8
26 8
2,0 | 13,3 4
£.6 13 4

(11) 2 | ⅙ | 1740 at 2¾d.
½ | ½ | 290
¼ | ¼ | 72 6
36 3
2,0 | 39 8 9
£.19 189

(12) 3 | ¼ | 746 at 3d.
2,0 | 18,6 6
£.9 6 6

(13) 3 | ¼ | 1417 at 3¾d.
¾ | 1½ | 354 3
29 6¼
2,0 | 38 3 9¼
£.19 3 9¼

(14) 3 | ¼ | 3091 at 3½d.
⅙
772 9
128 9½
2,0 | 90,1 6½
£.45 1 6½

(15) 3 | ¼ | 214 at 3¾
¾ | ¼ | 53 6
13 4½
2,0 | 6,6 10½
£.3 6 10½

(16) 4 | ⅓ | 2000 at 4d.
2,0 | 66,6 8
£.33 6 8

(17)

d.
(17) 3 | ¼ | 569 at 4¼d.
1 | ⅓ | 142 3
¼ | ¼ | 47 5
11 10¼
2,0 | 20,1 6¼
£.10 1 6¼

d.
(18) 3 | ¼ | 1246 at 4½d.
1½ | ½ | 311 6
155 9
2,0 | 46,7 3
£.23 7 3

(19) 3 | ¼ | 1426 at 4¾d.
1 | ⅓ | 356 6
¾ | ¾ | 118 10
89 1½
2,0 | 56,4 5½
£.28 4 5½

(20) 4 | ⅓ | 2740 at 5d.
1 | ¼ | 913 4
228 4
2,0 | 114,1 8
£.57 1 8

(21) 4 | ⅓ | 2147 at 5¼d.
1 | ¼ | 715 8
¼ | ¼ | 178 11
44 8¾
2,0 | 93,9 3¾
£.46 19 3¾

(22) 4 | ⅓ | 674 at 5½d.
1½ | ⅜ | 224 8
84 3
2,0 | 30,8 11
£.15 8 11

(23) 3 | ¼ | 1746 at 5¾d.
2 | ⅔ | 436 6
¾ | ¼ | 291 0
109 1½ = ¼ of 3d.
2,0 | 83,6 7½
£.41 16 7½

(24) 6 | ½ | 1741 at 6d.
2,0 | 87,0 6
£.43 10 6

	d.		
(25)	4	⅓	2142 at 6¼d.
	2	½	714
	¼	⅛	357
			44 7½
		2,0	111,5 7½
			£.55 15 7½

	d.		
(26)	6	½	1040d. at 6½d.
	½	1/12	520
			43 4
		2,0	56,3 4
			£.28 3 4

(27)	6	½	1746 at 6¾d.
	¾	⅛	873
			109 1½
		2,0	98,2 1½
			£.49 2 1½

(28)	4	⅓	1000 at 7d.
			333 4
	3	¾	250 0
		2,0	58,3 4
			£.29 3 4

(29)	6	½	1656 at 7¼d.
	1	⅙	828
	¼	¼	138
			34 6
		2,0	100,0 6
			£.50 0 6

(30)	6	½	1420 at 7½d.
	1½	¼	710
			177 6
		2,0	88,7 6
			£.44 7 6

(31)	4	⅓	674 at 7¾d.
			224 8
	3	¼	168 6
	¾	¼	42 1½=¼ of 3
		2,0	42,5 3½
			£.21 15 3½

(32)	6	½	2170 at 8d.
	2	⅓	1085
			361 8
		2,0	144,6 8
			£.72 6 8

	d.			
(33)	6	$\frac{1}{2}$	1700 at $8\frac{1}{4}$*d.*	
	2	$\frac{1}{3}$	850	
	$\frac{1}{4}$	$\frac{1}{8}$	283	4
			35	5
		2,0	116,8	9
			£.58 8	9

	d.			
(34)	6	$\frac{1}{2}$	1765 at $8\frac{1}{2}$*d.*	
	2	$\frac{1}{3}$	882	6
	$\frac{1}{2}$	$\frac{1}{4}$	294	2
			73	$6\frac{1}{2}$
		2,0	125,0	$2\frac{1}{2}$
			£.62 10	$2\frac{1}{2}$

(35)	6	$\frac{1}{2}$	749 at $8\frac{3}{4}$*d.*	
	2	$\frac{1}{3}$	374	6
			124	10
	$\frac{3}{4}$	$\frac{1}{8}$	46	$9\frac{3}{4}=\frac{1}{8}$ of 6*d.*
		2,0	54,6	$1\frac{3}{4}$
			£.27 6	$1\frac{3}{4}$

(36)	6	$\frac{1}{2}$	1417 at 9*d.*	
	3	$\frac{1}{2}$	708	6
			354	3
		2,0	106,2	9
			£.53 2	9

(37)	6	$\frac{1}{2}$	2373 at $9\frac{1}{4}$*d.*	
	3	$\frac{1}{2}$	1186	6
	$\frac{1}{4}$	$\frac{1}{12}$	593	3
			49	$5\frac{1}{4}$
		2,0	182,9	$2\frac{1}{2}$
			£.91 9	$2\frac{1}{4}$

(38)	6	$\frac{1}{2}$	1476 at $9\frac{1}{2}$*d.*	
		$\frac{1}{3}$	738	
	2		246	[6*d.*
	$1\frac{1}{2}$	$\frac{1}{4}$	184	$6=\frac{1}{4}$ of
		2,0	116,8	6
			£.58 8	6

(39)	6	$\frac{1}{2}$	1760 at $9\frac{3}{4}$*d.*	
	3	$\frac{1}{2}$	880	
	$\frac{3}{4}$	$\frac{1}{4}$	440	
			110	
		2,0	143,0	
			£.71	10

(40)	6	$\frac{1}{2}$	6000 at 10*d.*
			3000
	4	$\frac{1}{3}$	2000
		2,0	500,0
			£.250

	d.		
(41)	6		4652 at 10¼*d.*
	3	½	2326
	1	⅓	1163
	¼	¼	387 8
			96 11
		2,0	397,3 7
			£.198 13 7

	d.		
(42)	6	½	2476 at 10½*d.*
	3	½	1238
	1½	½	619
			309 6
		2,0	216,6 6
			£.108 6 6

(43)	6	½	2176 at 10¾*d.*
			1088
	4	⅓	725 4=⅓ of 1*s.*
	¾	⅛	135 0=⅛ of 6*d.*
		2,0	194,9 4
			£.97 9 4

(44)	6	½	1276 at 11*d.*
	3	½	638
			319
	2	⅓	212 8=⅓ of 6*d.*
		2,0	116,9 8
			£.58 9 8

(45)	6	½	2142 at 11¼*d.*
			1071
	4	⅓	714
	1	¼	178 6
	¼	¼	44 7½
		2,0	200,8 1½
			£.100 8 1½

(46)	6	½	4760 at 11½*d.*
			2380
	4	⅓	1586 8
	1½	¼	595 0=¼ of 6*d.*
		2,0	456,1 8
			£.228 1 8

(47)	6	½	640 at 11¾*d.*
	3	½	320
			160
	2	⅓	106 8=⅓ of 6*d.*
	¾	¼	40 0=¼ of 3.
		2,0	62,6 8
			£.31 6 8

	d.		
(48)	6	½	1074 at 1*s*. 10¾*d*.
			537
	4	⅓	358
	¾	⅛	67 1½
		2,0	203,6 1½
			£.101 16 1½

When the Price is 2, 3, 4, 6, or 8*d*. you may make Uſe of this Method. — Thus; for 2*d*. divide the given Quantity by 120; for 3*d*. by 80; for 4*d*. by 60; for 6*d*. by 40, and for 8*d*. by 30, which will give the Anſwering Pounds, &c.

	d.		
(49)	¼	¼	2140 at 1*s*. ¼*d*.
		12	535
			44 7 added to [2140
		2,0	218,4 7
			£.109 4 7

	d.		
(50)	6	½	1749 at 1*s*. 11½*d*.
	1½	¼	874 6
	4	⅓	218 7½
			583 0
		2,0	342,5 1½
			£.171 5 1½

(51)	4	⅓	2140 at 1*s*. 5*d*.
	1	¼	713 4
			178 4
		2,0	303,1 8
			£.151 11. 8

(52)	6	½	1453 at 1*s*. 7½*d*.
	1½	¼	726 6
			181 7½
		2,0	236,1 1½
			£.118 1 1½

	d.		
(53)	6	½	1614 at 1*s.* 10*d.*
			807
	4	⅓	538
		2,0	295,9
			£.147 19

	d.		
(54)	6	½	2647 at 1*s.* 11¾*d.*
	3	½	1323 6
			661 9
	2	⅓	441 2=⅓ of 6*d*
	¾	¼	165 5¼
		2,0	
			523,8 10¼
			£.261 18 10¼

The 53d Example may be performed thus — 1*s.* 8*d.* is $\frac{1}{12}$ of a Pound, 2*d.* is $\frac{1}{10}$ of 1*s.* 8*d.*

(55) 2476 at 2*s.*
1
£. 247 12

(56) 1476 at 4*s.*
2
£. 295 4

(57) 276 at 6*s.*
3
£. 82 16

(58) 2100 at 8*s.*
4
£. 840 0

(59) 274 at 10*s.*
5
£. 137,0

(60) 674 at 12*s.*
6
£. 404 8

(61) 2680 at 14*s.*
7
£. 1876 0

(62) 267 at 16*s.*
8
£. 213 12

(63) 1267 at 18*s.*
9
£. 1140 6

The 55, 56, and 59 Examples may be performed thus: 2*s.* is $\frac{1}{10}$, 4*s.* in $\frac{1}{5}$, and 10*s.* is ½ of a Pound, therefore the given Quantities being divided by 10, 5, and 2 will give the Anſwer, as above.

(64) 2174 at 7*s.*
7
2,0)1521,8
£.760 18

(65) 1427 at 9*s.*
9
2,0)1284,3
£.642 3

(66) 647 at 11*s.*
11
2,0)711,7
£.355 17

(67) 267 at 13*s.*
13
2,0)347,1
£.173 11

(68) 274 at 17*s.*
17
2,0)465,8
£.232 18

(69) 1260 at 19*s.*
19
2,0)2394,0
£.1197 0

(70) 4*s.* $\frac{1}{5}$)2420 at 4*s.*
£.484

(71) 5*s.* $\frac{1}{4}$)1764 at 5*s.*
£.441

(72) 1*s.* 8*d.* $\frac{1}{12}$)4762 at 1*s.* 8*d.*
£.396 16 8

(73) 2*s.* 6*d.* $\frac{1}{8}$)467 at 2*s.* 6*d.*
£.58 7 6

(74) 3*s.* 4*d.* $\frac{1}{6}$)1760 at 3*s.* 4*d.*
£.293 6 8

(75) 6*s.* 8*d.* $\frac{1}{3}$)176 at 6*s.* 8*d.*
£.58 13 4

d.
(76) 3 $\frac{1}{4}$ 1420 at 3*s.* 3*d.*
3
4260
355
2,0 461,5
£.230 15

d.
(77) 6 $\frac{1}{2}$ 427 at 5*s.* 9*d.*
5
2135
3 $\frac{1}{2}$ 213 6
106 9
2,0 245,5 3
£.122 15 3

d.		
(78) 6	$\frac{1}{2}$	402 at 10*s.* 8$\frac{3}{4}$*d.*
		10
		4020
2	$\frac{1}{3}$	201
		67
$\frac{3}{4}$	$\frac{1}{8}$	25 1$\frac{1}{2}$=$\frac{1}{8}$ of 6.
	2,0	431,3 1$\frac{1}{2}$
		£.215 13 1$\frac{1}{2}$

d.		
(79) 6	$\frac{1}{2}$	174 at 17*s.* 9$\frac{1}{2}$*d.*
		17
		2958
3	$\frac{1}{2}$	87
$\frac{1}{2}$	$\frac{1}{6}$	43 6
		7 3
	2,0	309,5 9
		£.154 15 9

(80)

3	$\frac{1}{4}$	273 at 19*s.* 4$\frac{3}{4}$*d.*
		19
		5187
1	$\frac{1}{3}$	68 3
		22 9
$\frac{3}{4}$	$\frac{1}{4}$	17 0$\frac{3}{4}$=$\frac{1}{4}$ of 3*d.*
	2,0	529,5 0 $\frac{3}{4}$
		£.264 15 0$\frac{3}{4}$

(81)

6	$\frac{1}{2}$	260 at 14*s.* 11$\frac{3}{4}$*d.*
		14
		3640=14*s.*
3	$\frac{1}{2}$	130= 6*d.*
		65= 3
2	$\frac{1}{3}$	43 4=2
$\frac{3}{4}$	$\frac{1}{4}$	16 3=$\frac{1}{4}$ of 3*d.*
	2,0	389,4 7
		£. 194 14 7

Example 76 may be performed thus — 2*s.* is $\frac{1}{10}$, 1*s.* is $\frac{1}{2}$ of 2*s.* and 3*d.* is $\frac{1}{4}$ of 1*s.* — Example 77, thus; 5*s.* is $\frac{1}{4}$, 6*d.* is $\frac{1}{10}$ of 5*s.* and 3*d.* is $\frac{1}{2}$ of 6*d.* Likewiſe Example 78, thus; 10*s.* is $\frac{1}{2}$ of a Pound, 6*d.* is $\frac{1}{20}$ of 10*s.* 2*d.* is $\frac{1}{3}$ of 6*d.* and $\frac{3}{4}$ is $\frac{1}{8}$ of 6*d.* which Parts added together will give the Anſwers, as before.

(82) 120 at 4£.
4
£. 480

(83) 96 at 17£.
17
£.1632

(84) 100 at 3£.
3
£. 300

(85) 142 at 42£.
6×7=42
£. 5964

(86) 649 at 2£. 6s.
2
1298
194 14
£. 1492 14

(87) 526 at 7£. 16s.
7
3682
420 16
£. 4102 16

(88) 142 at 1£. 17s.
17
2,0)241,4
120 14 added to 142£.
£. 262 14

(89) 1s. $\frac{1}{20}$ 164 at 24£. 19s.
5×5=25
4100
—8 4
£. 4091 16

(90) 271 at 5£. 7s.
5
1355£.
2,0)189,7=271×7
94 17 added to 1355£.
£. 1449 17

(91) 5 | $\frac{1}{4}$ | 604 at 20£. 9s.
20
12080
151
4 | $\frac{1}{6}$ | 120 16
£. 12351 16

(92) 10s. $\frac{1}{2}$ | 914 at 10£. 15s.
10
9140
5 $\frac{1}{2}$ | 457
228 10
£. 9825 10

(93) 737 at 1£. 14s.
7
515 18 added to 737£.
£. 1252 18

(94)
6s. 8d. $\frac{1}{3}$ | 274 at 7£. 6s. 8d.
7
1918
91 6 8
£. 2009 6 8

(95)
3s. 4d. $\frac{1}{6}$ | 120 at 12£. 3s. 4d.
12
1440
20
£. 1460

(96)
1s. 8d. $\frac{1}{12}$ | 97 at 9£. 1s. 8d.
9
873
8 1 8
£. 881 1 8

(97)
5s. $\frac{1}{4}$ | 512 at 42£. 5s.
7×6=42
21504
128
£. 21632

(98)
1472 at £. 4 6s. 7$\frac{1}{2}$d.
4
6$\frac{1}{12}$d. | 5888
441 12 See Caſe 4
1$\frac{1}{2}$ | $\frac{1}{4}$ | 36 16
9 4
£. 6375 12

(99)
10s. | $\frac{1}{2}$ | 279 at £. 6 11s. 9$\frac{1}{4}$d.
6
1674 0
1 | $\frac{1}{10}$ | 139 10
6d. | $\frac{1}{2}$ | 13 19
3 | $\frac{1}{2}$ | 6 19 6
$\frac{1}{4}$ | $\frac{1}{4}$ | 3 9 9
0 17 5$\frac{1}{4}$
£. 1838 15 8$\frac{1}{4}$

(100)

10s.	½	1420 at £.19 14 11¾			
		19			
		26980			
		710			
4	½	284			
6d.	⅛	35	10=⅛ of 4s.		
3	½	17	15=½ of 6		
2		11	16	8	
¾	¼	4	8	9	
		£.28043	10	5	

(101)

4d.	⅓	2074 at £.1 17 5½			
		37		20	
		76738		37	
		691	4		
1½	⅛	259	3		
	2,0	7768,8	7		
		£.3884	8	7	

(102)

£.	s.	d.
27 at 4	11	8¾
		9×3=27
41	5	6¾
		3
£.123	16	8¼

(103)

£.	s.	d.
64 at 12	13	7¼
		8×8=64
101	8	10
		8
£.811	10	8

(104)

		£.	s.	d.
2 qrs.	½		17	6
				7
		6	2	6
1	½		8	9
			4	4½
16 lb.	⅐		2	6
2	⅛			3¼
		£.6	18	5¼

(105)

dwts.		£.	s.	d.
10d.	½	3	16	10½
				6
		23	1	3
				7
		161	8	9
				10
		1614	7	6
		1	18	5¼
4	½		15	4½
1	¼		3	10
gr. 8	⅓		1	3¼
8	⅓		1	3¼
		£.1617	7	8¼

(106)

(106)

72 C. 3 *qrs.* 19 *lb.* at

qrs.	*lb.*		*£.*	*s.*	*d.*	
2		½	3	17	4½	
						9×8=72
			34	16	4½	
					8	
			278	11	0	
1		½	1	18	8¼	
	16	⅐		19	4	
	2			11	0½	
	1	½		1	4½	
					8¼	
		£.	282	2	1½	

(107)

12 C. 1 *qr.* 17 *lb.* at

lb.		*£.*	*s.*	*d.*
1	¼	4	4	4
				12
		50	12	0
14	½	1	1	1
2	⅐		10	6½
1	½		1	6
				9
	£.	52	5	10½

(108)

23 C. 18 *lb.* at

lb.		*£.*	*s.*	*d.*		
		4	14	1½		
						11×2+1=23
		51	15	4½		
				2		
16	⅐	103	10	9		
		4	14	1½		
2	⅛		13	5¼	$\frac{3}{7}$	
			1	8	$\frac{4}{7}$	
	£.	109	0	0		

(109)

(109)

s.	d.					
5		¼	476	*A.* 3*r.* 28*p.* at		£. 3 s. 7 d. 11
			3			
			1428			
			119			
2	6	½	59	10		
	5	⅙	9	18	4	
2	*r.*	½	1	13	11½	= ½ of 3 7 11
1	*p.*	½		16	11¾	
	20	½		8	5¾	
	8	⅕		3	4¾	
			£. 1619	11	1¼	

(110)

16*C.* 2*qrs.* at

		£.	s.	d.
2	½	2	6	11
				4×4=16
		9	7	8
				4
		37	10	8
		1	3	5½
		£. 38	14	1½

(111)

48*C.* 2*qrs.* 7*lb.* at

		£.	s.	d.
2 *qrs.*	½	74	16	6
				8×6=48
		598	12	0
			6	
		3591	12	0
7*lb.*	⅛	37	8	3
		4	13	6¼
		£. 3633	13	9¼

(112)

24*lb.* at

lb.		£.	s.	
16	⅐	4	17	per *C.*
8	½	0	13	10¼
		0	6	11
		£. 1	0	9¼

(113)

17*lb.* at

lb.		£.	s.	d.
14	⅛	3	5	4
2	⅐	0	8	2
1	½	0	1	2
		0	0	7
		£. 0	9	11

When the Pupil is perfect in all the preceding Caſes, he may then learn the Contractions, ſome of which are as follow:

CONTRACTIONS TO CASE I. AND II.

(1)

d.

3 | $\frac{1}{80}$ | 1276 at ¾

¼ | ¼ | 15 19

£. 3 19 9

(2)

d.

3 | $\frac{1}{80}$ | 174,0 at 2¾*d.*

¼ | $\frac{1}{12}$ | 21 15 0 } ſubtract
1 16 3 }

£. 19 18 9

(3) See Example 3.

s. d.

2 6 | $\frac{1}{8}$ | 1420 at 7½

7½ | ¼ | 177 10

£. 44 7 6

See Example 30.

CONTRACTIONS TO CASE III. VII. AND IX.

(4)

s. d.

1 8 | 12 | 3162 at 1*s.* 7*d.*

1 | $\frac{1}{20}$ | 263 10 0 } ſubt.
13 3 6 }

£. 250 6 6

(5)

3*d.* | $\frac{1}{80}$ | 427 at 5*s.* 9*d.*
3

128,2 0 } ſubtract.
5 6 9 }

£. 122 15 3

(6)

2*d.* | $\frac{1}{120}$ | 246 at 17*s.* 10*d.*
9

221 8 } ſubtract.
2 1 }

£. 219 7

(7)

(7)
1s. | $\frac{1}{20}$ | 241 at £.6 19
7
1687 } ſubtract.
12 1 0 }
£. 1674 19 0

(8)
5s. | $\frac{1}{4}$ | 641 at £.1 15
2
1282 0 } ſubtract.
160 5 }
£.1121 15

17. TARE AND TRETT.

(1)
	C.	qr.	lb.		C.	qr.	lb.
Groſs,	6.	2.	17×6×4(24 *hhds.*)=		159	2	16
Tare,	—		—	—	17	3	27
				Anſwer, Net Wt.	141	2	17

(2)
				C.	qr.	lb.
Groſs,	—	—	—	23	2	19
Tare,	—	—	—	1	—	12
			Anſwer, Net Wt.	22	2	7

(3)
	C.	qr.		C.	qr.	lb.
Groſs,	2	3	} × 8 Frails. { =	22	—	—
Tare,		22*lb.*	} { =	1	2	8
			Anſwer, Net Wt.	20	1	20

(4)
	C.	qr.	lb.		C.	qr.	lb.
Groſs Wt.	3	—	27	} ×5×8(40) { =	129	2	16
Tare,	—	—	18	} { =	6	1	20
				Anſwer, Net Wt.	123	—	24

(5)
	C.	qr.	lb.		C.	qr.	lb.	oz.
Groſs Wt.	2	1	17	×2×11(22 Barrels) =	52	3	10	—
Tare 14*lb*, per *Cwt.* is $\frac{1}{8}$				— =	6	2	11	12
				Anſwer, Net Wt.	46	0	26	4

(6) Groſs Wt. 6*C.* 2*qr.* 12*lb.* × 9*d.* *s.* = 59*C.* 1*qr.* 24*lb.*

14*lb.* | $\frac{1}{8}$ | 59 1 24 Groſs.

2 | $\frac{1}{7}$ | 7 1 20 8

1 | $\frac{1}{2}$ | 1 0 6 14 $\frac{6}{7}$

| | 0 2 3 7 $\frac{3}{7}$

9 0 2 14 $\frac{2}{7}$ Tare.

Anſwer, 50 1 21 1 $\frac{5}{7}$ Net Weight.

(7) *C.* *qr.* *lb.*

16 3 0 Groſs.

1 1 12 Tare.

4*lb.* | $\frac{1}{26}$ | 15 1 16 Suttle.

0 2 10 $\frac{4}{13}$ Tret.

Anſwer, 14 3 5 $\frac{9}{13}$ Neat Weight.

C.qr.lb. *C.* *qr.* *lb.*

(8) Groſs, 2,3,27, × 3 × 9 (27 Bags) = 80 3 1

16*lb.* | $\frac{1}{7}$ | 80 3 1 Groſs.

8 | $\frac{1}{2}$ | 11 2 4 2 Tare, ſuppoſing it had been 16*lb.*

4 | | 5 3 2 1

1 | $\frac{1}{4}$ | 2 3 15 0 8

| | 0 2 24 12 2

9 1 13 13 10 Tare.

4*lb.* $\frac{1}{26}$ 71 1 15 2 6 Suttle.

2 2 27 8 1 $\frac{6}{13}$ Tret.

Anſwer, 68 2 15 10 4 $\frac{7}{13}$ Net.

(9) *C.* *qr.* *lb.*

2*lb.* $\frac{1}{168}$ 5647 3 18 Groſs.

33 2 13 $\frac{41}{160}$ Cloff.

Anſwer, 5614 0 14 $\frac{119}{160}$ Net.

(10)

		C.	qr.	lb.		
2lb.	$\frac{1}{168}$	3)42	3	0		Groſs.
		7)14	1	0		
		8) 2	0	4		
		0	1	0	8	Cloff.
Anſwer,		42	1	27	8	Net.

(11)

		C.	qr.	lb.	oz.	
14lb.	$\frac{1}{8}$	15	3	20		
7	$\frac{1}{2}$	1	3	27		Tare, ſuppoſing it had been 14lb.
		0	3	27	8	Tare.
4	$\frac{1}{26}$	14	3	20	8	Suttle.
		0	2	8	5	Tret.
2	$\frac{1}{168}$	14	1	12	2	=Second Suttle.
		0	0	9	8	Cloff.
		14	1	2	10	Net.

(12)

		C.	qr.	lb.		
16lb.	$\frac{1}{7}$	20	3	13		Groſs.
8	$\frac{1}{2}$	2	3	25	$13\frac{5}{7}$	Tare, ſuppoſing 16lb. per C.
		1	1	26	$14\frac{6}{7}$	Tare.
4	$\frac{1}{26}$	19	1	14	$1\frac{1}{7}$	Suttle.
		0	2	27	7	Trett.
2	$\frac{1}{168}$	18	2	14	$10\frac{1}{7}$	=Second Suttle.
		0	0	12	$6\frac{2}{7}$	Cloff.
Anſwer,		18	2	2	$3\frac{6}{7}$	Net.

(13)	£.	s.	d.	C.	qr.	lb.	
Neat proceeds,	4	14	6 $\frac{1}{10}$	9	3	10	Groſs.
Cuſtom, &c.	2	8	6	0	3	26$\frac{1}{5}$	Tare.
Freight,	1	2	8				
Factorage,	0	4	9	C. 8	3	11$\frac{4}{5}$	Nett=4959 Fifths
				And 1C.=560 Ditto.			
	£.8	10	5=2045 Pence.				
			d.				

Stated thus—If 4959 : 2045 :: 560

560

4959)1145200(230$\frac{3}{4}$*d.* $\frac{3643}{4959}$, or £.0 19*s.* 2$\frac{3}{4}$*d.* $\frac{3643}{4959}$; the Anſwer.

(14)

Firſt, 1180×80=94400 Inches, which, ÷ by 231, (the Number of Inches in a Gallon) gives 408$\frac{132}{231}$ Gallons; theſe × 7$\frac{1}{2}$*lbs.* the Number of *lbs.* in a Gallon) gives 3064$\frac{216}{231}$*lbs.* Groſs, which, ÷ by 10=306$\frac{114}{231}$*lb.* Tare; this, taken from the Groſs,=2758$\frac{102}{231}$*lb.* Neat.

Then, ſtated thus—As 112*lb.* : 4*s.* 6*d.* or 54*d.* :: 2758$\frac{102}{231}$*lb.* 1329$\frac{3}{4}$*d.* $\frac{22032}{25872}$, or £.5 10*s.* 9$\frac{3}{4}$*d.* $\frac{22032}{25872}$ the Anſwer.

18. SIMPLE INTEREST.

(1) Firſt, £.824 18*s.* 2*d.* Principal.×by 4, Rate per Cent. =£.3299 12*s.* 8*d.* which, ÷ by 100, gives £.32 19*s.* 11*d.* $\frac{3}{25}$, the Anſwer.

(2) Firſt, 500£.÷2 0=25. Intereſt for 1 Year; this, × by 4, (the Number of Years)=100£. the Anſwer.

(3) Firſt, £.264 0*s.* 4*d.* ÷ 20=£.13 4 4$\frac{4}{5}$ Intereſt for 1 Year, this, × by 12 (the Time) £.158 8*s.* 2$\frac{1}{4}$*d.* $\frac{3}{5}$ Intereſt; which, added to the Principal, gives £.422 8*s.* 6$\frac{1}{4}$*d.* $\frac{3}{5}$, the Amount required.

(4) Firſt, £.246 18*s.* × 4$\frac{1}{4}$=£.1049 6 6 which ÷ 100= £.10 9 10$\frac{1}{4}$ $\frac{3}{25}$ the Intereſt required.

(5) Firſt, £.140 10*s.* × 4$\frac{1}{2}$=£.632 5*s.* 0*d.* ÷ 100= £.6 6*s.* 5$\frac{1}{4}$*d.* $\frac{3}{5}$ Intereſt for a Year, which, × by 7,= £.44 5*s.* 1$\frac{1}{4}$*d.* $\frac{1}{5}$ Intereſt for 7 Years, the Anſwer.

(6) Firſt, £.470 × 3¾ = £.1762 10*s*. ÷ 100 = £.17 12*s*. 6*d*. Intereſt for a Year; which × 5 = £.88 2*s*. 6*d*. Interſst for 5 Years; this added to the Principal, viz. £.470 = £.558 2*s*. 6*d*. the Amount required.

(7) Firſt, £.474 14*s*. 6*d*. × 3¼ = £.1542 17*s*. 1½*d*. this ÷ by 100, gives £.15 8*s*. 6¼*d*. $\frac{21}{50}$ the Commiſſion required.

(8) Firſt, 2½ = $\frac{1}{40}$, Then £.74,2 12*s*. 6*d*. ÷ 4,0 = £.18 11*s*. 3¾*d*. the Anſwer.

BROKERAGE.

(9) Firſt, £.420 12*s*. 6*d*. ÷ 100 = £.4 4*s*. 1½*d*.

		£.	*s*.	*d*.
4*s*.	$\frac{1}{5}$	4	4	1½
		0	16	9¾
2	½	0	8	4¾
4*d*.	$\frac{1}{6}$	0	1	4¾
Anſwer,		£ 1	6	7¼ Brokage.

(10) Firſt, 1000£. ÷ 100 = 10£. Then

s. *d*.		£.
4 0	$\frac{1}{5}$	10 at 4*s*. 6*d*.
6	$\frac{1}{8}$	2 0
		0 5
Anſwer,		£. 2 5

(11) Firſt, £.540 10*s*. ÷ 100 = £.5 8*s*. 1*d*. then

s. *d*.		£.	*s*.	*d*.
10 0	½	5	8	1 at 13 10
3 4	⅓	2	14	0½
		0	18	0
6	$\frac{1}{20}$	0	2	8¼
Anſw.		£.3	14	8¾

(12) Firſt, £.2474 15*s*. ÷ 100 = £.24 14*s*. 11¼*d*. then

s. *d*.		£.	*s*.	*d*.
10 0	½	24	14	11¼ at 19 9½
		12	7	5¼
6 8	⅓	8	4	11¾
2 6	¼	3	1	10¼
7½	¼	0	15	5½
Anſw.		£.24	9	9

(13)

INSURANCE.

(13) Firſt, 14,60£.÷100=£.14 12s.
Then, £.14 12s.÷8(2s. 6d.=⅛)=£1. 16s. 6d. Inſurance required.

(14) Firſt, £.2460×10¾=£.26445, which÷100=£.264 9s. the Inſurance required.

(15) Firſt, £.2500×6$\frac{7}{8}$=£.17187 10s. which÷by 100=£.171 17s. 6d. the Inſurance required.

(16) Firſt, £.7406 17s. 6d.×15¾=£.1166 11s. 7¾d. which÷100=£.1166.11s. 7¾d. ½ the Inſurance required.

PURCHASING of STOCKS.

(17) Firſt, 400£.×20¼÷100=81£.
Then, 400+81=481£. the Purchaſe required.

(18) Firſt, £.470×87¾=41242£. 10s. which÷by 100=£.412 8s. 6d. the Purchaſe required.

(19) Firſt, £.2470 17s. 10d.×3½ (the Exceſs)=£.8648 2s. 5d. which, ÷ 100=£86 9s. 7½d.$\frac{96}{100}$; this, added to £2470 17s. 10d. the Stock, gives £.2557, 7s. 5¼d.$\frac{246}{2500}$ the Anſwer.

(20) Firſt, 876£.×14$\frac{5}{8}$ (the Exceſs)=£.12811 10s. which ÷ by 100=£.128 2s. 3½d.$\frac{4}{10}$; this, added to 876£. the Stock, gives £.1004 2s. 3½d.$\frac{2}{5}$ the Purchaſe required.

(21) Firſt, 427£. 10s.×4÷100=17£. 2s.
Then, 17£. 2s.÷3 (4 Mo.=⅓)=5£. 14s. the Intereſt required.

(22)

	£.		£.	s.	d.	
5	$\frac{1}{20}$		246	12	6	
1 Year			=12	6	7½	Intereſt.
¼	¼		3	1	7¾ ½	
Anſwer,			£.15	8	3¾ ½	

(23)

		£.	s.			
5	1/20	209	18			
		10	9	10½	1/5	Subtract.
¼	1/20		10	5¼	3/5	
½	½	9	19	5¼	3/5	
				4		
		39	17	8½	2/5	=4 Years Intereſt.
		4	19	8¼	3/5	=½
		209	18	0		=Principal.
	Anſwer,	254	15	4	½	

(24)

		£.	s.	d.		
5	1/10	604	17	6		
½	1/10	30	4	10½		
		3	0	5¾	1/5	
6 Mo.	½	33	5	4¼	1/5	
					3	
		99	16	1	4/5	=3 Years Intereſt.
3	½	16	12	8	4/5	=6 Months.
		8	6	4	2/5	=3 Ditto.
		604	17	6		Principal.
	Anſw.	£.729	12	7½		the Amount.

(25) Firſt, 400£. 15s.×4÷100=£16 0 7⅕ Intereſt for 1 Year. Then

w. £. s. d. w. £. s. d.
As 52 : 16 0 7 :: 4 : 1 4 7¼ the Intereſt required.

(26) Firſt, 600×3¾=22,50£. this÷by 1,00=£.22 10s. the Intereſt for one Year.

w.		£.	s.	
26	½	22	10	
		11	5	Intereſt for 26 Weeks.
		600	0	Principal.
	Anſwer,	£.611	5	

(27) Firſt, 740£.÷20=37£. Intereſt for a Year; then

If 52*W.* : 37£. :: 42*W.*

Here 37×42=1554£. theſe ÷ by 52=£.29 17*s.* $8\frac{1}{4}d.\frac{3}{13}$ the Intereſt for 42 Weeks, which, added to 37£.×4, viz. 148£. the Intereſt for 4 Years, gives £.177 17*s.* $8\frac{1}{4}d.\frac{3}{13}$, the Intereſt for 4 Years, 42 Weeks, the Anſw.

(28) Firſt, 200£.×4½=900£.÷100=9£. Intereſt for a Year; which×5=45£. Intereſt for 5 Years; then

If 52*W.* : 9£. :: 50*W.*

Here 9×50=450£.÷52=£.8 13*s.* $0\frac{3}{4}d.\frac{9}{13}$, Intereſt for 50 Weeks; which added to 45£. the Intereſt for 5 Years, gives £.53 13*s.* $0\frac{3}{4}d.\frac{9}{13}$, the whole Intereſt; this added to 200£.=£.253 13*s.* $0\frac{3}{4}d.\frac{9}{13}$, the Amount required.

(29) Firſt, 200×3½÷100=7£. Intereſt for 1 Year.
Now, 73 Days,=⅕ of 1 Year.
Therefore 7£.÷5 gives £.1 8*s.* 0*d.* the Intereſt required.

(30) Firſt, £.340 10*s.*÷20=£.17 0 6 the Intereſt for a Year.

And from January the 1ſt to July the 18,=199 Days by the Table; or ſee Q. 1. P. 29, then,

D. £. *s.* *d.* *D.*
If 365 : 17 0 6 :: 100

Here £.17 0*s.* 6*d.*=4086 Pence; theſe × 199=813114*d.* which÷365=$2227\frac{1}{2}d.\frac{306}{365}$, or £.9 5*s.* $7\frac{1}{2}d.\frac{306}{365}$ Anſw.

(31) Firſt, 500£.×4=2000£.÷100=20£. Intereſt for a Year.

And from December the 4th, 1789, to March the 10th, 1791=1 Year, 96 Days; then

D. £. *D.*
If 365 : 20 :: 96

Here 96×20=1920£. this÷365=£.5 5*s.* $2\frac{1}{4}\frac{315}{365}d.$ Intereſt for 96 Days; which, added to 20£. (Intereſt for a Year)=£.25 5*s.* $2\frac{1}{4}d.\frac{315}{365}$, the Intereſt required.

(32) Firſt, £.4 10*s.* Rate×9½ Year's Time=£.42 15*s.* Intereſt of 100£. for 9½ Years; which Intereſt added to 100£.=£.142 15*s.* the Amount; then,

£. *s.* £. £. *s.*
If 146 15 : 100 :: 856 10

Here £.142 15*s.*=2855*s.* and £.856 10*s.*=17130*s.* which ×100=1713000£. theſe÷2855=600£. the Anſwer.

(33) Firſt, 3£. Rate, ×7¾, Time =£.23 5*s.* Intereſt; which, added to 100, Principal,=£.123 5*s.* the Amount; then,

£. s. £. £. s. d.
If 123 5 : 100 :: 614 3 11

Here £.123 5s.=29580d. and £.614 3s. 11d.=147407d.× 100=14740700£.÷29580=£.498 6s. 8d. the Anſw.

(34) Firſt, £.600×4½=2700£.÷100=27£. Intereſt of 600£. for a Year; and from £.856 10s. take 600£. remains 256£. 10s. Intereſt of 600£. for the whole Time; then,

£. Y. £. s.
If 27 : 1 :: 256 10
20 20
54,0)513,0(9½ Years, Anſwer.

(35) Firſt, £.498 6s. 8d. × 3 = £.1495 this ÷ 100= £.14 19s. Intereſt of the given Principal for a Year; then from £.614 3s. 11d. take £.498 6s. 8d. leaves £.115 17s. 3d. Intereſt of the Principal for the whole Time; then,

£. s. Y. £. s. d.
If 14 19 : 1 :: 115 17 3

Here £.14 19s.=3588d. and £.115 17s. 3d.=27807d. which÷3588=7¾ Years, the Anſwer.

(36) Firſt, from £.856 10s. take 600£. Remains £.256 10s. Intereſt of the 600£. for 9½ Years.

£. £. s. s. £.
If 600 : 256 10 or, 5130 :: 100
100
6,00)5130,00(855s. Intereſt of 100£. for 9½ Years, which÷9½, viz. 19 Half-Years, gives 45s. or £.2 5s. Intereſt of 100£. for Half a Year, which×2=£.4 10s. per Cent. the Anſwer.

(37) Firſt, from £.614 3s. 11d. take £.498 6s. 8d. Remains £.115 17s. 3d. Intereſt; then,

£. s. d. £. s. d. £.
If 498 6 8 : 115 17 3 :: 100
Reduced, 119600d. : 27807 :: 24000d.
24000
1196,00)6673680,00(5580d. or 465s.

And 7¾=31 Qrs. then, 31)465(15s.×4=3£. per Cent. the Anſwer.

(38) Firſt, 5000£. × 4½ = 225,00£. ÷ 1,00 = 225£. Intereſt for a Year; which ÷ 4 = £.56 5s. Intereſt due to Lady-Day, which is a Quarrer, and in this Manner proceed with each new Principal for the Intereſt.

1789.	£.			
Chriſtmas, lent —	5000 at 4½ per Cent.			
1790. Inter. due to Lady-D.	56	5		
Amount, — — —	5056	5		
Drew out —	194	5		=185 Guineas.
Remains — —	4862	0		New Principal.
Intereſt of which to Midſ.	54	13	11¼	
Amount, —	4916	13	11¼	
Paid in 500 Moidores,=	675	0	0	
Sum, — — —	5591	13	11¼	
Drew out, —	700	0	0	
Remains, —	4891	13	11¼	New Principal.
Intereſt to Michaelmas,	55	0	7½	
Amount, — —	4946	14	6¾	
Paid in Part, —	569	17	0	
Anſwer, £.	5516	11	6¾	

(89)

1789.			£.	Days.	Products.
May	1.	Lent per Bill at one Day's Date,	500	13	6500
	13.	Received in Part, —	50		
		Balance, — — —	450	22	9900
June	4.	Received in Part, —	56		
		Balance, — — —	394	40	15760
July	14.	Received in Part, —	44		
		Balance, — —	350	9	3150

Carried over, Sum 35310

		£	Days	Products
	Brought over,	350		35310
23.	Received in Part, —	50		
	Balance, — —	300	26	7800
Aug. 18.	Received in Part, —	87		
	Balance, — —	213	12	2556
30.	Received in Part, — —	13		
	Balance, — —	200	22	4400
Sept. 21.	Received in Part, —	30		
	Balance, — — —	170	27	4590
Oct. 18.	Received in Part, —	30		
	Balance, — —	140	11	1540
29.	Received in Part, — — —	40		
	Balance, — —	100	13	1300
Nov. 11.	Received in Part, —	50		
	Balance, — —	50	47	2350
Dec. 28.	Received in full of Principal, —	50		
			Sum of the Products,	59846

Then, 73,00)598,46(8£. 3s. 11½d. $\frac{116}{730}$ Interest due on this Account.

(40)

		£.	s.	d.	Days	Products £.	s.	d.
	To a Bill at one Day's Date,	878	19	10	40	35159	13	4
Feb. 27.	Received in Part,	57	15	7				
	Balance, —	821	4	3	19	15603	0	9
Mar. 18.	Received in Part,	37	14	0				
	Balance, — —	783	10	3	42	32907	10	6
April 29.	Received in Part,	34	11	0				
	Carried over,	748	19	3	13	9736	10	3
						93406	14	10

		£.	s.	d.	Days	Product £.	s.	d.
	Balance, —	748	19	3		93406	14	10
May 12.	Received in Part,	136	15	7				
	Balance, —	612	8	8	58	23262	19	4
June 19.	Received in Part,	67	13	4				
	Balance, —	544	10	4	26	14157	8	8
July 15.	Received in Part,	15	15	6				
	Balance, —	528	14	10	10	5287	8	4
5.	Received in Part,	111	11	11				
	Balance, —	417	2	11	70	29200	4	2
Oct. 3.	Received in Part,	78	7	4				
	Balance, —	338	15	7	47	15922	12	5
Nov. 19.	Received in Part,	100	0	0				
	Balance, —	238	15	7	4	955	2	4
23.	Received in Part,	100	0	0				
Dec. 30.	Received in full of the Principal	138	15	7	37	5134	16	7
		138	15	7				
	Sum of the Products, £.					187327	6	8

Then 73,00)187347£. 6s. 8d. (25£. 13s. 2½d. $\frac{604}{730}$, the Intereſt required.

(41) Firſt, from 109 Moidores take 2s. 6d. Rem. 147 0 6
Amount of the Bond,
And 109 Guineas =114 9 0

Difference or Intereſt, £. 32 11

Alſo, £. 114 9s. Principal, × 4 Rate, =£.4,57 16s. this ÷1,00, =£.4 11s. 6½d. Intereſt for a Year.

Then

£. s. d. Yea. £. s. d.
Then—If 4 11 $6\frac{1}{2}$: 1 :: 32 11 6
Reduced. 2197 Halfpence : 1 :: 15636 Halfpence : therefore
2197)15636(7 Years, 42 Days, the whole Time.

July hath 31 Days } Sum 49—42=7th of July, the Anſ.
Till Auguſt 18th, }

(42) Firſt, £.39 19*s.* 8*d.*=9596 Pence; then per Sect. 15.

Prin. Yrs. Intereſt.
Placed thus, { 100 : 12 : 9596
{ 1 : 0 : 240

Then 240×12×100=288000 Dividend, which ÷ by 9596 =30 Years, $4\frac{5416}{9596}$ Days, the Anſwer.

(43) Firſt, from Aug. 7, 1778, to May 11, 1781=2 Years, 277 Days.

	£.	s.	d.	
The 1ſt Bond was made for	1114	10	0	at 6 per Ct.
Intereſt of which for 2 Y. 277 D. is	184	9	$9\frac{1}{5}$	
Sum,	1298	19	$9\frac{2}{5}$	Amount.
May 11, Paid off, —	140	0	0	
2d Bond, — —	1158	19	$9\frac{2}{5}$	
Due Sept. 19, —	21	16	8	
Sum,	1180	16	$5\frac{2}{5}$	Amount.
Sept. 5, Paid off, —	87	11	9	
3d Bond, — —	1093	16	$8\frac{2}{5}$	} ſubtract.
Sept. 11, Received in full,	1409	16	8	
Intereſt,	316	12	$0\frac{2}{5}$	

Then, from September 19, 1781, to September 19, 1789,= 7 Years, 357 Days, or 2912 Days, 3d Bond or Principal, viz. £.1093 4*s.* 8*d.*=262376 Pence. £.316 12*s.* 0*d.* =303956 Farthings, and a Year = 365 Days; then, by Caſe 6, or rather by Sect 15; thus—

Prin.	*Time.*		*Intereſt.*
262376	2912	::	303936
24000	365	::	

Then 262376×2912=764038912 the Diviſor.

And 303936×365×24000=2660079360000 the Dividend.

Therefore, 764038912)2660079360000(3481 $\frac{459907328}{764038912}$ Farthings, or £.3 12*s.* 6¼*d.* the Anſwer required.

The Time of the 2d Bond's Continuance is found, thus—

P.	*Time.*	*Int.*				*qrs.*	*D.*	*d.*
100	365	5 5 0	Red.			24000	365	1260
1158 19 9	—	21 16 8				278 57	—	5240

Then 278157×1260=350477820 the Diviſor.

5240×365×24000=45902400000 the Dividend.

350477820)45902400000(131 Days nearly ſince May 11, which anſwers to Sept. 19, as before mentioned.

(44)

$$\text{If he puts in } \left\{\begin{matrix} £. \\ 100 \\ 200 \\ 300 \end{matrix}\right\} \text{ to have } \left\{\begin{matrix} £. \\ 40 \\ 55 \\ 70 \end{matrix}\right\} \text{ per Year.}$$

$$\text{Then from } \left\{\begin{matrix} £. \\ 55 \\ 70 \end{matrix}\right\} \text{ take } \left\{\begin{matrix} £. \\ 40 \\ 55 \end{matrix}\right\} = 15 \text{ per C. for his Mon.}$$

$$\text{And } \left\{\begin{matrix} £. \\ 40 \\ 55 \\ 70 \end{matrix}\right\} - \left\{\begin{matrix} £. \\ 15 \\ 30 \\ 45 \end{matrix}\right\} = 25£. \text{ per Year for his Attendance.}$$

(45)

	£.	*s.*	*d.*
Firſt 900£. at 111⅜ per Cent. per Caſe 2.	=1002	7	6
Brokerage of Ditto, at 2*s.* 6*d.* per Cent.	=1	2	6
	£. 1003	10	0
Midſummer Dividend, at 2 per Cent.	18	0	0
	£.985	10	0
Intereſt of £1003 10*s.* for 49 Days, at 5 per Cent. — — —	6	14	8
Brokerage of £.400 at 2*s.* 6*d.* per Cent.	0	10	0
Carried over,	£.992	14	8

	£.	s.	d.
Brought over,	992	14	8
Sold 400£. at 92½ per Cent.	370	0	0
	622	14	8
Intereſt for ½ Year, due Feb. 10, 1746,	15	11	4¼
	638	6	0¼
Dividend received at that Time, — —	10	0	0
	628	6	0¼
Intereſt due to Auguſt 10, — —	15	14	1¾
	644	0	2
Dividend received at that Time, —	10	0	0
	634	0	2
Intereſt due to Feb. 1747, — —	15	17	0
	649	17	2
Dividend received then, — —	10	0	0
	639	17	2
Intereſt to the 10th of Auguſt, —	15	19	11
	655	17	1
Midſummer Dividend, received Auguſt 10,	10	0	0
	645	17	1
Sold off 500£. at 102⅝ per Cent. —	512	2	6
	133	14	7
Brokerage, — — — —	0	12	6
To my Damage in the whole, —	£. 133	2	1

(19) COMPOUND INTEREST.

(1)

£.	£.	s.		
5 $\frac{1}{20}$	600	0	0	=1ſt Year's Principal.
	30	0	0	= ——— Intereſt.
5 $\frac{1}{20}$	630	0	0	=ſecond Year's Principal.
	31	10	0	= ——— Intereſt.
5 $\frac{1}{20}$	661	10	0	=third Year's Principal.
	33	1	6	= ——— Intereſt.
	694	11	6	=Amount.
	600	0	0	=Principal.
Anſwer,	£. 94	11	6	

(2)

Firſt, 150£. × 4 = 6,00£. ÷ 100 = 6£. Intereſt, which added to 150=156£. ſecond Year's Principal; then 156£. × 4 = 624£. ÷ 100=6£. 4s. 9½d. Intereſt, + 156£.=£. 162 4s. 9½d. third Year's Principal, which ×4.=£.648 19s. 2d. ÷ 1,00=£.6 9s. 9½d. Intereſt, which added to £.162 4s. 9½d. = £.168 14s. 7d. = fourth Year's Principal, which × 4, = £.674 18s. 4d. ÷100 = £.6 14s. 11d. fourth Year's Intereſt, which added to £.168 14s. 7d.=£.175 9s. 6¼d.=fiſth Year's Principal, which×4,=£.701 18s. 3d. this ÷ 100=£.7 0s. 4½d. fiſth Year's Intereſt, which, added to £.175 9s. 6¼d.=£.182 9s. 11¼d. the Amount required.

(3)

		£.	s.	d.	
5	$\frac{1}{20}$	440	16	0	=1ſt Year's Principal.
		22	0	9½	= ——— Intereſt.
5	$\frac{1}{20}$	462	16	9½	=ſecond Year's Principal.
		23	2	10	= ——— Intereſt.
5	$\frac{1}{20}$	485	9	7¼	=third Year's Principal.
		24	5	11¾	= ——— Intereſt.

£. s. d.

5 $\frac{1}{20}$ 510 5 7¼=fourth Year's Principal.

25 10 3¼= ———— Intereſt.

[mount of 4 Years.

5£. $\frac{1}{20}$ 535 15 10½=fifth Year's Principal, or A-

6 *M.* ½ 26 15 9½= ———— Intereſt.

1 $\frac{1}{6}$ 13 7 10¾

15 *D.* ½ 2 4 7¾

1 2 3¾

16 14 10¼=Intereſt for 7 Mo. 15 Days.

535 15 10½=4th Year's Amount.

552 10 8¾=Amount for 4Y. 7M. 15D.

440 16 0 =Principal.

Anſwer, £. 111 14 8¾ Compound Intereſt.

20. REBATE or DISCOUNT.

£. £. £. £.

6 *Mo.* ½ 5 Then as, 103 : 3 :: 420 : £.12 4 7¾ $\frac{71}{103}$ the Rebate required.

1 6*D.* $\frac{1}{5}$ 2 10

0 10

3 0 0 Intereſt.

100 0 0 Principal.

£. 103 0 0 Amount of 100£. for the given Time.

(2) First, 100+6=106£. Amount of 100£. for a Year.

Then—If 106£. : 100£. :: 100£.

×100

106)10000(£.94 6s. 9½*d.* $\frac{2}{53}$ Anſwer.

(3)

(3) *Mo.* £. £. s. d. £. s. d. £. s. d.
6 | ½ | 4 then—If 103 6 8 : 100 :: 600 10 6
| | 3 Or, 24800*d.* : 100 :: 144126*d.*
4⅓ | 1 6 8
248,00)144126,00(£.581 3*s.* ¾ $\frac{3}{31}$*d.*
Int. for 10M. 3 6 8 preſent Worth, which taken
Principal, 100 0 0 from the Principal, leaves
£.19 7*s.* 5*d.* Anſwer.
Amount, 103 6 8

(4) Firſt, from December 13, to July 27,=227 Days.
Then—If 365*D.* : 5£. :: 227 Days.
227
365)1135(£.3 2*s.* 2¼*d.* Rebate of 100£.
for 227 Days.

£. s. d. £. s. d. £. s.
Again.—If 103 2 2¼ : 3 2 2¼ :: 890 16
Or, 98985*qrs.* : 2985*qrs.* :: 855168*qrs.*
855168
98985)2552676480(25788*qrs.* or £.26 17*s.* 3*d.* the Anſwer.

(5) Firſt, one half of 430£.=215£.
Mo. £. £. *s.* *d.* £. *s.* *d.* £.
4 ⅓ 5 If 101 13 4 : 1 13 4 :: 215
Intereſt, 1 13 4 Or, 24400*d.* : 400*d.* :: 51600*d.*
Prin. 100 0 0 51600
Amt. 101 13 4 244,00)206400,00(845¾*d.* or £.3 10*s.* 5¾*d.* Diſc. of one half for 4 Mon.

Again, £.1 13*s.* 4*d.* × 2=£.3 6*s.* 8*d.* Intereſt for 100£. for 8 Months.
£. *s.* *d.* £. *s.* *d.* £.
Then—If 103 6 8 : 3 6 8 :: 215
or, 24800*d.* : 800*d.* :: 51600*d.*
51600
248,00)412800,00(1664½*d.* or £.6 18*s.* 8½*d.* Diſcount of Half for 8 Months, which, added to that for 4 Months, gives £.10 9*s.* 2¼*d.* Anſwer.

(6)

(6) Firſt, from May 21, to Chriſtmas, = 218 Days; then—
If 365*D*. : 5£. :: 218 Days.
218
365)1090(£.2 19*s*. 8½*d*. Intereſt of 100£. for 218 Days.
£. s. d. £. £.
Again,—If 102 19 8½ : 100 :: 550
or, 98866*qrs*. : 100 :: 528000*qrs*.
528000
98866)52800000(£.534 1*s*. 1¼*d*. Anſwer.

(7) *Mo*. £. £. s. £. £.
3 ¼ 6 then—101 10 : 100 :: 100
Intereſt, 1 10 or—If 2030*s*. : 100 :: 2000*s*.
Prin. 100 0 2000
Amount, 101 10 203,0)20000,0(£.98 10*s*. 5¼*d*. preſent Worth of 100£. for 3 Months.—Again,

Mo. £. £. s. £. £.
4 | ⅓ | 6 then—If 102 10 : 100 :: 60
1 | ¼ | 2 0 £.
0 10 or—If 2050*s*. 100 :: 1200*s*.
1200
Intereſt, 2 10
Principal, 100 0 205,0)12000,0(£.58 10*s*. 8¾*d*. preſent Worth of 60£. for 5 Months.
Amount, 102 10

Now, 100 + 60 = 160£. And 3220£. — 160£. = 3060£. for 9 Months.
Mo. £. £. s. £. £.
6 | ½ | 6 If 104 10 : 100 :: 3060
3 | ½ | 3 Or, 2090*s*. : 100 :: 61200*s*.
1 10 612
Intereſt, 4 10 209,0)6120,0(£.2928 4*s*. 7*d*. preſent
Prin. 100 0 Worth of 3060£. for 9 Months; therefore all the preſent Worths, added together, will be £.3085 5*s*. 9*d*. the Anſwer.
Amt. 104 10

(8)

(8) Firſt, $\frac{1}{5}$th of 400£.=80£. for three Months.

Mo. £. *s.* £. *s.* *d.* £. *s.*
3 $\frac{1}{4}$ 4 10 then—If 101 2 6 : 100 :: 80

Intereſt, 1 2 6 Or, 4045 : 100 :: 3200 Sixpences,
Princip. 100 0 0 4045)320000(£.79 2*s.* 2$\frac{1}{4}$*d.* the preſent Worth of 80£. for 3
Amount 101 2 6 Months.

Again, $\frac{1}{2}$ of 400£.=200£. for 6 Months.

Mo. £. *s.* £. *s.* £. £.
6 $\frac{1}{2}$ 4 10 then—If 102 5 : 100 :: 200

Intereſt, 2 5 Or, 2045*s.* : 100 :: 4000*s.*
Princip. 100 0 2045)400000(£.195 11*s.* 11$\frac{3}{4}$*d.* the preſent Worth of 200£. for
Amount 102 5 6 Months.

Now, 80+200=280£. And 400—280=120£. to continue for three Times 3 Months, which is 9 Months.

Mo. £. *s.* £. *s.* *d.* £. £.
6 $\frac{1}{2}$ 4 10 then—If 103 7 6 : 100 :: 120

3 $\frac{1}{2}$ 2 5 Or, 4135 : 100 :: 4800 Six-pences,
$\frac{1}{4}$ 1 2 6 4135)480000(£.116 1*s.* 7$\frac{1}{2}$*d.* the preſent Worth of 120£. for 9
Intereſt, 3 7 6 Months.
Princip. 100 0 0

£. 103 7 6

Now all the preſent Worths added together gives £.390 15*s.* 9$\frac{1}{2}$*d.* which, taken from 400£. Value of the Goods, leaves £.9 4*s.* 2$\frac{1}{2}$*d.* the Rebate.

(9) Firſt. $\frac{1}{3}$ of 360£.=120£. to continue 5 Months.

Mo. £. £. *s.* £. £.
4 $\frac{1}{2}$ 3 then—If 101 5 : 100 :: 120

1 $\frac{1}{2}$ 1 0 2025*s.* : 100 :: 240*s.*
0 5 2025)24000(£.118 10*s.* 4$\frac{1}{4}$*d.* the preſent Worth of 120£. for 5
Intereſt, 1 5 Months.
Princip. 100 0
Amount, 10 1 5

Again, 360—120=240£. to continue 10 Months.

Mo.		£.	
6 ½		3	
		1	10
4 ⅓		1	0
Intereſt;		2	10
Princip.		100	0
Amount,		102	10

£. s. £. £.
then—If 102 10 : 100 :: 240

Or, 2050*s.* : 100 :: 4800*s.*

205,0)480000(£. 234 2*s.* 11*d.* preſent Worth of 240£. for 10 Mo. which, added to that for 5 Mo. will make £.352 13*s.* 3¼*d.* the preſent Worth required.

(10) 5£. $\frac{1}{20}$ 500£. Principal.

25 Intereſt of 500£. for one Year; then 25£.×12=300£. Intereſt for 12 Years.

Again, 5×12=60£. Intereſt of 100£. for 12 Years.

Then, As, 160£. : 60£. :: 500£. : 187£. 10*s.*

∵ 300£.—187£. 10*s.*=112£. 10*s.* Advantage to Intereſt.

(11)

Mo.		£.	*s.*	*d.*
6	½	4	7	6=4 ⅜£.
				2
		8	15	0
3	½	2	3	9
15*D.*	⅙	1	1	10½
		0	3	7¾
10	⅓	0	2	5
Inter.		12	6	8¼
Prin.		100	0	0
Amt.		112	6	8¼

then—If 112£. 6*s.* 8¼*d.* : 100£. :: 13377£. 13*s.* 4*d.*

or, 107841*qrs.* : 100 :: 1284256o*qrs.*

107841)1284256000(£.11908 15*s.* 9¾*d.* $\frac{06801}{107844}$, the ready Money required.

21. EQUATION OF PAYMENTS.

(1) £. *Mo. Prod.*
$200 \times 3 = 600$
$150 \times 4 = 600$
$250 \times 6 = 1500$
6,00) 27,00
Anſwer, 4 Months 15 Days.

(2) £. *Mo. Prod.*
$200 \times 7 = 1400$
$260 \times 5 = 1300$
46,0) 270,0(5*M.* 26$\frac{4}{46}$*D.*
Anſwer, 5*M.* 26$\frac{2}{23}$*d.*

(3) Here ſuppoſe 120£. to be the Sum owed.

$$\text{then}\left.\begin{matrix}\frac{1}{2}\\ \frac{1}{3}\\ \frac{1}{6}\end{matrix}\right\}\begin{matrix}\pounds.\\ 120=\\ \end{matrix}\left\{\begin{matrix}60,\times 3=180\\ 40,\times 4=160\\ 20,\times 9=180\end{matrix}\right.$$

12,0)520(4 Mo. 10 D. Anſwer.

(4) Here, as the Debt is to be had at four equal Payments, and $\frac{1}{4}$ being paid down, there remains $\frac{3}{4}$ to be paid, at three equal Payments; conſequently, the Sum of the different Times that each Payment is to be made, being divided by 3, will give the Anſwer, thus,
$4+5+6=15$, this, $\div 3 = 5$ Months, the Anſwer.

(5) £. *Mo. Prod.*
Owed, $240 \times 5 = 1200$
Paid down, 40
Remains, 20,0)12,00(6 Months, the Anſwer.

22. SINGLE FELLOWSHIP.

(1) Firſt, $80+60=140$£. their Stock,—Then,

$$\begin{matrix}\pounds. & & \pounds.\\ \text{As } 140 & : & 28\end{matrix} :: \left\{\begin{matrix}\pounds. & & \pounds.\\ 80 & : & 16\text{ A.'s}\\ 60 & : & 12\text{ B.'s.}\end{matrix}\right\}\text{gain.}$$

(2) Firſt, $320+340=660$£. G and D put in; then, from 824£. take 660£. remains 164£. E.'s Stock, and $824 + 70 = 894$£. their whole Gain; therefore,

$$\begin{matrix}\pounds. & & \pounds.\\ \text{As } 824 & : & 894\end{matrix} :: \left\{\begin{matrix}\pounds. & & \pounds. & s. & d. & \textit{Rem.}\\ 320 & : & 347 & 3 & 8\frac{1}{4} & 72\text{C.'s}\\ 340 & : & 368 & 17 & 8 & 128\text{D.'s}\\ 164 & : & 177 & 18 & 7\frac{1}{2} & 624\text{E.'s}\end{matrix}\right\}\text{Gain.}$$

(3) Here, ſuppoſe 600£. to be their Stock; then

$\left.\begin{array}{l}\frac{1}{2}\\\frac{1}{3}\\\frac{1}{4}\\\frac{1}{5}\end{array}\right\}$ of 600£.$=\left\{\begin{array}{l}\overset{\pounds.}{300}\text{A.'s}\\200\text{B.'s}\\150\text{C.'s}\\120\text{D.'s}\end{array}\right\}$Stock.

770 Sum-

Stated thus,

$\text{As } \overset{\pounds.}{770} : \overset{\pounds.}{120} :: \left\{\begin{array}{l}\overset{\pounds.}{300}\\200\\150\\120\end{array}\right.$

Anſw. as below.

By Fractions, thus —$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$,—$\frac{60}{120}$, $\frac{40}{120}$, $\frac{30}{120}$, and $\frac{24}{120}$.—Then, 60+40+30+24=154.

$\therefore\text{As } 154 : \overset{\pounds.}{120} :: \left\{\begin{array}{lllll}\overset{\pounds.}{60} : & \overset{\pounds.}{46} & \overset{s.}{15} & \overset{d.}{0\frac{3}{4}} & \overset{Rem.}{9}\text{A.'s}\\40 : & 31 & 3 & 4\frac{1}{2} & 6\text{B.'s}\\30 : & 23 & 7 & 6\frac{1}{4} & 43\text{C.'s}\\24 : & 18 & 14 & 0\frac{1}{4} & 19\text{D.'s}\end{array}\right\}\text{Loſs.}$

(4) Firſt, 30+48+42=120£. their whole Gain.—Then

$\text{As } \overset{\pounds.}{120} : \overset{\pounds.}{400} :: \left\{\begin{array}{l}30 : 100\text{D.'s}\\48 : 160\text{E.'s}\\42 : 140\text{F.'s}\end{array}\right\}\text{Stock.}$

(5)

$\text{Firſt, }\left.\begin{array}{lll}\overset{\pounds.}{1000} & & =\overset{s.}{20000}\text{ A.'s}\\640 & & =12800\text{ B.'s}\\900 & & =18000\text{ C.'s}\\842 & 16 & =16856\text{ D.'s}\end{array}\right\}\text{Debt.}$

Sum, 3382 16=67656, the whole Debt.

And 2420£. 17*s.* 6*d.*=581010 Pence, his whole Worth.

Then,

$\text{As, } \overset{s.}{67656} : \overset{d.}{581010} :: \left\{\begin{array}{llllll}\overset{s.}{20000} : & \overset{d.}{171754} & =\overset{\pounds.}{715} & \overset{s.}{12} & \overset{d.}{10}\\12800 : & 109922\frac{1}{2} & =458 & 0 & 2\frac{1}{2}\\18000 : & 154578\frac{1}{4} & =644 & 1 & 6\frac{3}{4}\\16856 : & 144754\frac{3}{4} & =603 & 2 & 10\frac{1}{4}\end{array}\right.$

$\left.\begin{array}{r}\overset{Rem.}{45504}\text{ A.}\\45360\text{ B.}\\360\text{ C.}\\44038\text{ D.}\end{array}\right\}\text{Received.}$

(6) Here, ſuppoſe 420, as it will divide by 3, 4, 5, 6, and by 7, and have no Remainder, then $\frac{1}{3}$ of $420=140$ A, $\frac{1}{4}=105$ B, $\frac{1}{5}=84$ C, $\frac{1}{6}=70$ D, and $\frac{1}{7}=60$ E, therefore, added together, $=\frac{459}{420}$, then, neglecting the Denominator, the Statings will ſtand thus:

$$\text{As } \overset{\pounds.}{459} : 500 :: \left\{\begin{array}{rcrrrl} \pounds. & & \pounds. & s. & d. & \\ 140 & : & 152 & 10 & 1\frac{1}{4} & 105 \text{ A's} \\ 105 & : & 114 & 7 & 6\frac{3}{4} & 423 \text{ B's} \\ 84 & : & 91 & 10 & 0\frac{3}{4} & 63 \text{ C's} \\ 70 & : & 76 & 5 & 0\frac{1}{2} & 282 \text{ D's} \\ 60 & : & 65 & 7 & 2\frac{1}{4} & 45 \text{ E's} \end{array}\right\} \text{Share.}$$

Or by Fractions, thus, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{7}$, $=\frac{840}{2520}$, $\frac{630}{2520}$, $\frac{504}{2520}$, $\frac{420}{2520}$, and $\frac{390}{2520}$. Here neglecting the Denominator, and the Sum of the Numerators will be the firſt Term, and each Numerator the third; then proceed as above, will give the Anſwer.

(7) Firſt, $\frac{3}{8}+\frac{3}{7}=\frac{21}{56}+\frac{24}{56}=\frac{45}{56}=$ A + B's = Part. Then, $\frac{56}{56}-\frac{45}{56}=\frac{11}{56}$ C's Part; then by neglecting the Denominator.

$$\text{As } 11 : 140 :: \left\{\begin{array}{rcrrrl} \pounds. & & \pounds. & s. & d. & \\ 21 & : & 267 & 5 & 5\frac{1}{4}\,\frac{7}{11} & \text{A} \\ 24 & : & 305 & 9 & 1\,\frac{4}{11} & \text{B} \end{array}\right\} \text{paid.}$$

(8) Firſt, $10+7=17$; then—

As 17*l.* : 52*l.* 10*s.* :: 10*l.* : 30*l.* 17*s.* $7\frac{3}{4}$*d.* $\frac{1}{17}$, A's Gain.

$$\begin{array}{lrcrcrrl} & \pounds. & & \pounds. & & \pounds. & s. & d. \\ \text{And,—If} & 45 & : & 100 & :: & 30 & 17 & 7\frac{3}{4}\,\frac{1}{17} \end{array}$$

Or, 734400 : 100 :: 504000 Seventeenth's.

7344,00)504000,00(£.68 12*s.* $6\frac{1}{2}$*d.* $\frac{2592}{7344}$ A's Adventure.

Again, — As 17*l.* : 52*l.* 10*s.* :: 7*l.* : 21*l.* 12*s.* 4*d.* $\frac{16}{17}$ B's Gain.

$$\begin{array}{lrcrcrrl} & \pounds. & & \pounds. & & \pounds. & s. & d. \\ \text{Alſo—If} & 45 & : & 100 & :: & 21 & 12 & 4\frac{16}{17} \end{array}$$

Or, 734400 : 100 :: 352800

7344,00)352800,00(£.48 0*s.* $9\frac{1}{4}$*d.* $\frac{4552}{7544}$ B's Adventure.

(9) Firſt, 50 Guineas = £.52 10*s.* B's Gain, which take from £.74 11*s.* A's Gain, leaves £.22 1*s.* Difference. £.52 10*s.* + £.74 11*s.* = £.127 1*s.* the whole Gain.

Then

£. s. £. s. d. £. s.
Then—If 22 1 : 19 19 8 :: 127 1
Or, 441*s.* : 4796*d.* :: 2541*s.*
2541

441)12186636(27634*d.* or £.115 2*s.* 10*d.* $\frac{42}{441}$ Coſt, which added to the Gain, viz. £.127 1*s.* = £.242 3*s.* 10*d.* or 58126 Pence, which ÷ by 55*s.* viz. 660 Pence, will give 88 Anchors, and 3*s.* 10*d.* over; then, £.127 1*s.* ÷ 88 = £.1 8*s.* 10½*d.* gained per Anchor.

(10) Firſt, from 14*s.* 6*d.* take 8*s.* 6*d.* remains 6*s.* A gains more than B; then,

$$\begin{array}{l} \quad\ \text{s.}\quad \text{d.} \qquad\quad \text{s.}\ \ \text{d.}\quad \text{£.}\ \ \text{s.}\ \ \text{d.} \\ \text{As } 6 : 35 : \left\{\begin{array}{l} 14\ \ 6 : 4\ \ 4\ \ 7 \text{ A's} \\ 8\ \ 6 : 2\ \ 9\ \ 7 \text{ B's} \end{array}\right\} \text{Stock.} \end{array}$$

(11) Firſt, 210 + 312 = 522£. Sum of A and B's Stock, and 140 — £.37 10*s.* = £.102 10*s.* their Gain, then,

$$\begin{array}{l} \quad\ \ \text{£.}\qquad \text{£.}\quad \text{s.}\qquad\qquad \text{£.}\quad \text{£.}\ \ \text{s.}\ \ \text{d.}\ \ \textit{Rem.} \\ \text{As } 522 : 102\ \ 10\text{s.} :: \left\{\begin{array}{l} 210 : 41\ \ 4\ \ 8\frac{1}{4}\ \ 108 \text{ A's} \\ 312 : 61\ \ 5\ \ 3\frac{1}{4}\ \ 414 \text{ B's} \end{array}\right\} \text{Gain.} \end{array}$$

As 102*l.* 10*s.* : 522 :: 37*l.* 10*s.* : 190*l.* 19*s.* 6*d.* $\frac{6}{41}$ C's Stock.

(12) Firſt, 8 + 5 = 13£. their Gain per Cent.

$$\begin{array}{l} \qquad\qquad\quad \text{£.}\qquad \text{£.}\qquad\ \ \text{£.}\quad \text{£.}\quad \text{s.}\quad \text{d.} \\ \text{Then—As } 13 : 154 :: \left\{\begin{array}{l} 8 : 94\ \ 15\ \ 4\frac{1}{2}\ \frac{6}{13} \text{ A's} \\ 5 : 59\ \ \ 4\ \ 7\frac{1}{4}\ \frac{7}{13} \text{ B's} \end{array}\right\} \text{Gain.} \end{array}$$

Anſw. A had for his trouble, 35 10 9 $\frac{12}{13}$

AB, AC, BC, AB, AC, BC,
(13) Firſt, $\frac{2}{7}$, $\frac{3}{8}$, $\frac{3}{10}$, = $\frac{160}{560}$, $\frac{210}{560}$, $\frac{168}{560}$, by Caſe 5, Sect. 38; then rejecting the Denominator, we ſhall have,
Firſt, 210—160 = 50 C's Share more than B's.
And 210—168 = 42 A's ————————.
Alſo, 160— 42 = 118 by A and B equally.

∴ 118

$$\left.\begin{array}{ll}\therefore & 118 \div 2 = 59 \text{ B's Share} \\ \text{And} & 59 + 42 = 101 \text{ A's} \\ \text{Alſo,} & 59 + 50 = 109 \text{ C's}\end{array}\right\} = 269 \text{ their Sum.}$$

$$\text{As £.}269 : 30\text{s.}\left\{\begin{array}{rcrrrl} & & \text{£.} & \text{s.} & \text{d.} & \text{Rem.} \\ 59 & : & 6 & 6\frac{3}{4} & 225 & \text{B's} \\ 101 & : & 11 & 3 & 180 & \text{A's} \\ 109 & : & 12 & 1\frac{3}{4} & \frac{133}{269} & \text{C's}\end{array}\right\}\text{Share of the 30s.}$$

$$\begin{array}{lccccccc} & \textit{Meal.} & & \textit{Malt.} & & \textit{Meal.} & & \textit{Malt.} \\ \text{(14) Firſt,—As} & 3 & : & 5 & :: & 8 & : & 13\frac{1}{3} = \frac{40}{3}\end{array}$$

Then, $8 + 7 + 13\frac{1}{3} = 28\frac{1}{3} = \frac{85}{3}$, their Sum.

$$\text{As } \frac{85}{3} : \left\{\begin{array}{lllll} & & & \textit{Qrs.} & \textit{Buſh.} \\ \frac{40}{3} :: \frac{100}{1} & : & \frac{800}{17} & = 47\frac{1}{17} & = 376\frac{8}{17} = \frac{6400}{17} \text{ Malt.} \\ \frac{8}{1} :: \frac{100}{1} & : & \frac{480}{17} & = 28\frac{4}{17} & = 225\frac{15}{17} = \frac{3840}{17} \text{ Meal.} \\ \frac{7}{1} :: \frac{100}{1} & : & \frac{420}{17} & = 24\frac{12}{17} & = 197\frac{11}{17} = \frac{3300}{17} \text{ Oatmeal.}\end{array}\right.$$

$$\left.\begin{array}{r}\frac{800}{17} = \frac{2}{3} = \frac{1200}{17} \\ \frac{480}{17} \\ \frac{420}{17} \times \frac{1}{2} = \frac{210}{17}\end{array}\right\}\text{Price of the}\left\{\begin{array}{l}\text{Malt.} \\ \text{Meal.} \\ \text{Oatmeal.}\end{array}\right.$$

Here the Denominator (17) may be omitted, and the Numerators divide by 30, the Quotient will ſtill retain the ſame Proportions.

$$3,0)120,0 + 48,0 + 21,0(= 40 + 16 + 7 = 63 \text{ Sum.}$$

$$\text{As } 63 : \overset{\text{£.}}{142} :: \left\{\begin{array}{rclrrl} & & & \text{£.} & \text{s.} & \text{d.} \\ 40 & : & \frac{5680}{63} = & 90 & 3 & 2\frac{2}{21} \text{ Malt.} \\ 16 & : & \frac{2272}{63} = & 36 & 1 & 3\frac{5}{21} \text{ Meal.} \\ 7 & : & \frac{994}{63} = & 15 & 15 & 6\frac{14}{21} \text{ Oatmeal.}\end{array}\right\}\text{Coſt.}$$

$$\left.\begin{array}{ll} & \qquad\qquad\qquad\qquad\qquad\qquad \text{s.} \quad \text{d.} \\ \text{Then,} & \frac{5680}{63} \div \frac{6400}{17} = \frac{96560}{403200}\text{£.} = 4 \quad 9\frac{30}{63} \text{ Malt.} \\ \text{And,} & \frac{2272}{63} \div \frac{3840}{17} = \frac{38624}{241920} = 3 \quad 2\frac{20}{63} \text{ Meal.} \\ \text{Alſo,} & \frac{994}{63} \div \frac{3300}{17} = \frac{16808}{211680} = 1 \quad 7\frac{10}{63} \text{ Oatmeal.}\end{array}\right\}\text{per Buſh.}$$

(15) Firſt, $\frac{12}{11}$ of $\frac{3}{8} = \frac{9}{22}$, B's Part.

And, $\frac{4}{13}$, $\frac{9}{22}$, $\frac{1}{6} = \frac{528}{1716}$, $\frac{702}{1716}$, $\frac{286}{1716}$, or $\frac{264}{858}$, $\frac{351}{858}$, $\frac{143}{858}$.

Then, $\frac{351}{858} - \frac{264}{858} = \frac{87}{858} =$ Difference betwixt A's and B's.

And, $\frac{143}{858} + \frac{87}{858} = \frac{230}{858}$ C's Part.

Alſo, $\frac{264}{858} + \frac{351}{858} + \frac{230}{858} = \frac{845}{858} =$ A's + B's + C's.

$\frac{858}{858} - \frac{845}{858} = \frac{13}{858}$ D's Part

$$\text{As } 858 : \overset{\text{£.}}{400} :: \left\{\begin{array}{rcrrrrl}\text{£.} & & \text{£.} & \text{s.} & \text{d.} & & \\ 264 & : & 123 & 1 & 6\frac{1}{4} & 726 & \text{A's} \\ 351 & : & 163 & 12 & 8\frac{1}{2} & 780 & \text{B's} \\ 230 & : & 107 & 4 & 6\frac{1}{4} & 54 & \text{C's} \\ 13 & : & 6 & 1 & 2\frac{1}{2} & 156 & \text{D's}\end{array}\right\}\text{Share.}$$

23. DOUBLE FELLOWSHIP;

OR,

FELLOWSHIP WITH TIME.

£. £.
(1) Firſt, 240×4= 960 A's
And, 120×6= 720 B's } Stock and Time.
Alſo, 200×8=1600 C's

Sum 3280 then,

£. £. s. d.
£. £. { 960 : 76 1 11¼ 216 A's
As 3280 : 260 :: { 726 : 57 1 5½ 80 B's } Gain.
{ 1600 : 126 16 7 32 C's

(2) 4×4×50= 800 Officers Pay and Time.
8×4×40= 1280 Midſhipmen's ditto.
120×3×28=10080 Sailors ditto.

12160 Sum.

£. s. d.
£. { 800 : 263 3 1¾ 704 Officers.
As 12160 : 4000:: { 1280 : 421 1 0½ 640 Midſhip.
{ 10080 : 3315 15 9¼ 1088 Sailors.

£. s. d. £. s. d.
∵ 263 3 1¾ ÷ 4=53 15 9¼ Officers
421 1 0¾ ÷ 8=52 12 7½ Midſh. } each, Fractions rejected.
3315 15 9¼ ÷ 120=27 12 7½ Sailors.

(3) 60×4=240 A's Stock and Time.
40×5=200 B's ditto.
30×3= 90 C's ditto.

530 Sum of their Stocks and Times.

$$\begin{array}{l} \\ \text{As } 530 : \overset{\pounds.}{40} :: \end{array}\left\{\begin{array}{lllll} & \pounds. & s. & d. & \textit{Rem.} \\ 240 : & 18 & 2 & 3 & 36 \text{ A's} \\ 200 : & 15 & 1 & 10\frac{1}{2} & 30 \text{ B's} \\ 90 : & 6 & 15 & 10 & 40 \text{ C's} \end{array}\right\}\text{Part.}$$

$$\begin{array}{ll} & \pounds.\ \ \textit{Mo.} \\ (4) & \left.\begin{array}{l} 400\times6=2400 \\ 200\times6=1200 \end{array}\right\}=3600 \text{ A's Stock and Time.} \\ & \left.\begin{array}{l} 360\times7=2520 \\ 460\times2=\ \ 920 \\ 340\times3=1020 \end{array}\right\}=4460 \text{ B's ditto.} \\ & \pounds.\ \ \textit{Mo.} \\ & \left.\begin{array}{l} 190\times8=1520 \\ 300\times2=\ \ 600 \\ 200\times2=\ \ 400 \end{array}\right\}=2520 \text{ C's ditto.} \end{array}$$

then $3600+4460+2520=10580$ their Sum.

$$\text{As } 10580 : \overset{\pounds.}{460} :: \left\{\begin{array}{lllll} & \pounds. & s. & d. & \textit{Rem.} \\ 3600 : & 156 & 10 & 5 & 920 \text{ A's} \\ 4460 : & 193 & 18 & 3 & 552 \text{ B's} \\ 2520 : & 109 & 11 & 3\frac{1}{2} & \frac{644}{1058} \text{ C's} \end{array}\right\}\text{Share.}$$

$$\begin{array}{l} \qquad\qquad\qquad\qquad\quad \pounds.\ \ s.\ \ d. \qquad\quad \pounds.\ \ \ s.\ \ d. \\ (5) \text{ Reciprocally, As } 19 : 84\ 12\ 6 :: 7 : 229\ 13\ 11\tfrac{1}{7} \end{array}$$

$$6\times3+1=19$$

$$7)\underline{\overline{1607\ 17\ 6}}$$

Anſwer, B's Adventure, £. 229 13 11$\frac{1}{7}$

(6) First, 20+£.26 5s.+32=£.78 5s. Sum of their Gains.

$$\begin{array}{l} \pounds.\ \ s.\ \ \ \pounds. \\ \text{As } 78\ \ 5 : 640 :: \end{array}\left\{\begin{array}{llllll} \pounds. & s. & \pounds. & s. & d. & \textit{Rem.} \\ 20 & 0 : & 163 & 11 & 6\frac{3}{4} & 225 \text{ A's} \\ 26 & 5 : & 214 & 13 & 11 & 980 \text{ B's} \\ 32 & 0 : & 201 & 14 & 6 & \frac{360}{1565} \text{ C's} \end{array}\right\}\begin{array}{c}\text{Stock} \\ \text{and} \\ \text{Time.}\end{array}$$

Therefore,

$$\left.\begin{array}{lllllll} \pounds. & s. & d. & & \pounds. & s. & d. \\ 163 & 11 & 6\frac{3}{4} & \div9= & 18 & 3 & 6 \text{ A's} \\ 214 & 13 & 11 & \div7= & 30 & 13 & 5 \text{ B's} \\ 201 & 14 & 6 & \div5= & 20 & 6 & 10\frac{3}{4} \text{ C's} \end{array}\right\}\text{Stock, Fract. rejected.}$$

(7) Firſt, 72£. 10*s.*=1450*s.* C's Stock; then by Sect. 15.

S. *T.* *G.*
1450 : 9 : 23 Here, 23×6=138 Diviſor.
—— : 6 : 13 And 1450×9×13=169650 Dividend.

£. *s.* *d.*
138)169650(1229*s.* 4*d.* $\frac{4}{23}$=61 9 4 A's Stock.

Again,—

S. *T.* *G.*
1450 : 9 : 23 Here, 23×5=115 Diviſor.
—— : 5 : 18 And, 145×9×18=234900 Dividend.

£. *s.* *d.*
115)234900(2042*s.* 7¼*d.* $\frac{25}{115}$=102 2 7¼ B's Stock.
72 10 0 C's ——.
61 9 4 A's ——.

Anſwer, the whole Stock, £.236 1 11¼

(8) Here ſuppoſe X's Gain to be 2
Then by the Queſtion Y's will be 3 } =9 their Sum.
And Z's — — — 4

£. *s.* *d.* *Pence.*
£.
2 : 93 6 8=22400 X's
Now as 9 : 420 : : 3 : 140 0 0=33600 Y's } Gain.
4 : 186 13 4=44800 Z's

Therefore, 22400×4= 89600 X's
33600×6=201600 Y's } Gain and Time.
44800×9=403200 Z's

694400

Now rejecting the 0's, we ſhall have the following Proportion.

£. *s.* *d.*
£.
896 : 549 18 8½ 448 X's
As 6944 : 4262 : : 2016 : 1237 7 1 4480 Y's } Stock.
4032 : 2474 14 2¼ 2016 Z's

(9) Firſt, $\frac{1}{5}+\frac{2}{3}=\frac{3}{15}+\frac{10}{15}=\frac{13}{15}$, then $\frac{15}{15}-\frac{13}{15}=\frac{2}{15}$ B's Gain; and rejecting the Denominator, we ſhall have A's Gain =3, B's 2, and C's 10; then

S. *T.* *G.*

S. *T.* *G.*
400 : 7 : 10 Here, 10×5=50 Diviſor.
—— : 5 : 3 And, 400×7×3=8400 Dividend.
5,0)840,0(168*l.* A's Stock.

Again,—
S. *T.* *G.*
400 : 7 : 10 Here, 10×8=80 Diviſor.
—— : 8 : 2 And, 7×2×400=5600 Dividend.
8,0) 560,0(70*l.* B's Stock.

(10)

		Days.	*Days.*
From Feb. 10, to June 10,	—	=122	=208 A's Time.
Jan. 17, to April 30,	—	= 61	
July 14, to 14 after St. James's,		=125	
Aug. 2, to Nov. 13,	—	=104	=179 B's.
May 1, to June 24,	—	= 55	
Sept. 30, to Oct. 19,	—	= 20	
			387 Horſe in Uſe.

D.	*£.*	*s.*		*D.*	*£.*	*s.*	*d.*	*Rem.*		
As 387	: 7	10	::	208 :	4	0	$7\frac{1}{4}$	$\frac{297}{387}$	A's	Share.
				179 :	3	9	$4\frac{1}{2}$	$\frac{90}{387}$	B's	

24. B A R T E R.

(1) Firſt, 4*Cwt.*=112×4=448*lb.* at 12*s.*
Then per Caſe 4. Sect. 16. 448×6=268*l.* 16— Value of the Tea.——Now,
As 1*l.* 10*s.* : 1 *Cwt.* :: 268*l.* 16*s.* Or,
As 30*s.* : 1 :: 5376*s.* : 179*Cwt.* $22\frac{2}{5}$*lb.* of Sugar, the Quantity required.

(2) Firſt, 45 Yds. at 1*s.* 4*d.*=3*l.* or 60*s.*
Then, 60÷18=$3\frac{1}{3}$ Yds.

(3) Firſt, 30*Cwt.*=3360*lb.* at $7\frac{1}{2}$*d.* per *lb.* Now,

d.			
6	$\frac{1}{40}$	336,0	then—As 6 *d.* : $7\frac{1}{2}$ *d.* :: 36 *s.* : 45 *s.*
$1\frac{1}{2}$	$\frac{1}{4}$		
		84	Again,—As 45*s.* : 1 *Cwt.* :: 2100*s.* : 46*Cwt.* 2*qrs.* $18\frac{2}{3}$*lb.* the Anſw.
		21	
		105*£.*=2100*s.*	

(4) If

s. *d.* *s.* *s.* *d.*
(4) If 8 6 : 10 :: 1 6 Or,
As 17*ſix-d.* : 10*s.* :: 13*ſix-d.* : 1*s.* 9$\frac{3}{17}$ per *lb.* the Anſ.

(5) Then—If 6 : 4 :: 20 Or,
As 1*ſix-d.* : 4*d.* : 800*ſix-d.* : 3200*d.*=13*l.* 6*s.* 8*d.* real Value of A's Currants.

Now 20*l.*÷2=10*l.* or 200*s.* and 6*s.* 8*d.*=80*d.* Value of B's Candles.

∵ As 7*s.* : 80 :: 200*s.* : 2285½*d.* $\frac{5}{7}$=

	£.	*s.*	*d.*	
	9	10	5½ $\frac{6}{7}$	real Value of B's Candles.
	10	0	0	gave in ready Money.
A received	19	10	5½ $\frac{6}{6}$	
For	13	6	8	
Anſwer, £.	6	3	9½ $\frac{6}{7}$	A got of B.

(6) *Cwt.* £. *s.* £. *s.* £. *s.*
Firſt, 18 at 1 11 per *C.*=1 11×3×6=27 18 real Value.
And ditto at 2 2———=2 2×3×6=37 16 Adv. Value.
∵ A advanced his Sugar, 9 18

Alſo, 3)37*l.* 16*s.*(=12*l.* 12*s.* A received in Caſh, and 37*l.* 16*s.*—12*l.* 12*s.*=25*l.* 4*s.* in Paper.

Again, 15*s.* 6*d.*—14*s.*=1*s.* 6*d.* B advanced his Paper.

Therefore,
s. *d.* *d.* £. *s.*
If 15 6 : 18 :: 25 4
×2 ×40 Sixpences in a £.
31 1008
×18
31)18144(585*d.* or 2*l.* 8*s.* 9¼*d.* $\frac{5}{31}$ B's advance on his Paper.

Then from 9*l.* 18*s.* take 2*l.* 8*s.* 9¼*d.* $\frac{5}{31}$. Rem. 7*l.* 9*s.* 2½*d.* $\frac{26}{31}$ in A's Favour, the Anſwer.

(7) Firſt,

£. s. £. s. £. s.

(7) Firſt, 5 6—4 5=1 1 Gain per Piece.
And 5 6÷2 =2 13 required down.

Alſo, 4 5—2 13=1 12 Value of the Half remaining.
+1 1

Made £.2 13 of the Half remaining.

£. s. £. s. d.
Then,—If 1 12 : 2 13 : : 3 Or,
As 128*three-d.* : 53*s.* : : 1*three-d.* : $4\frac{3}{4}$*d.* $\frac{28}{128}$ per *lb.* the Anſwer.

(8) Firſt, $\left.\begin{matrix}13 & 0\\ 11 & 10\end{matrix}\right\}\times 50=\left\{\begin{matrix}650 \text{ advanced Val. of the Cloth.}\\ 575 \text{ real Value.}\end{matrix}\right.$

£. 75

s. *d.* *s.* *d.*
Again, 2 6×2=5 0 adv. Value of the Wool per Tod.
—4 2 real Value.

0 10 Gain per Tod, or 5*d.* per Stone.

s. *d.* *St.* £.
If 2 6 : 1 : : 650 Or,

ſix-d. *St.* *ſix-d.* *St.*
As 5 : 1 : : 26000 : 5200 at 5*d.* per Stone. Now,

4*d.* | $\frac{1}{60}$ | 5200 Stone.
1 | $\frac{1}{4}$ | 86 13 4
| | 21 13 4

£.108 6 8 gained by the Wool.

A Sack=26 Stone; therefore, 5200÷26=200 Sacks, which will pay for the Cloth.

∴ 108*l.* 6*s.* 8*d.*—75*l.* = 33*l.* 6*s.* 8*d.* B's Gain by this Affair.

d. d. s. d.
(9) If 10 : 16 : : 20 or 240
240

10)3840

12)384

32s. advanced Value of the Malt.
20 real Value.

12s. B's Gain per Quarter.

Here 30 Guineas × 21 = 630 Shillings, which ÷ by 12 = $52\frac{1}{2}$ Quarters, or 420 Buſhels, the Anſwer.

(10) 720 Ells, at 5s. per Ell, or $\frac{1}{4}$ = 180l. Real } Value of the
Ditto ——— 6s. 8d. or $\frac{1}{3}$ = 240 Adv. } Holland.
240l. at 10l. per Ct. or $\frac{1}{10}$ = 24 Diſcount,
Then 240 − 24 = 216l.
And 216 ÷ 2 = 108 paid in ready Money.
£. £. s.
Then,—If 216 : 180 : : 36
20 180

4320)6480(1l. 10s. real Value per lb.

Now 108l. = 2160s. which ÷ 30 = 72lb. the Quantity delivered.

s. d. s. d.
(11) If 8 or 96 : 10 : : 6 : $7\frac{1}{2}$ Bar. Price of the Pamphlets.
100 Reams at 8s. = 40l. real } Value of the
Ditto, at 10s. = 50l. advanced } Paper.
$\frac{1}{4}$ = 50l. ÷ 4 = 12l. 10s. B to have in Caſh.
40l. Value of B's Pamphlets.
× 40 Sixpences in a £

1600 Pamphlets to be delivered.

From 40l. take 12l. 10s. Rem. 27l. 10s. what they then ſtood him in, ſo that the Advantage to B is 27l. 10s.

(12) First, 140*lb.* 11 *oz.*=1691*oz.*

5 *s.*	$\frac{1}{4}$	1691 at 6*s.* 4*d.*		
1	$\frac{1}{5}$	422	15	
4*d.*	$\frac{1}{3}$	84	11	
		28	3	8
		£. 535	9	8 real Value of the Plate.

s.	*d.*				
6	8	$\frac{1}{3}$	1691 at 7*s.* 2*d.*		
			563	13	4
	6	$\frac{1}{40}$	42	5	6
			£. 605	18	10

From 605 18 10 take 535 9 8 (£. *s.* *d.*, £. *s.* *d.*) Remains 70*l.* 9*s.* 2*d.* whole Advantage of A's Plate.

$\frac{1}{7}$ £.605 18 10—

86 11 3$\frac{1}{7}$ received in ready Specie.

£.519 7 6$\frac{6}{7}$

7*C.* 2*qrs.* 18*lb.*=858*lb.* at 11*s.* 2*d.*=

10*s.*	$\frac{1}{2}$	858 at 11*s.* 2*d.*		
1	$\frac{1}{10}$	429		
2*d.*	$\frac{1}{6}$	42	18	
		7	3	
		479	1	adv. Val. of B's Tea.

5 *s.*	$\frac{1}{4}$	858 at 9*s.* 6*d.*		
		214	10	
4	$\frac{4}{5}$	171	12	
6*d.*	$\frac{1}{8}$	21	9	
		407	11	real Value of B's Tea.

£.	*s.*	*d.*	
519	7	6$\frac{6}{7}$	
—479	1	0	
£. 40	6	6$\frac{6}{7}$	Disc. allowed by A.

	£.	*s.*	*d.*
	519	7	6$\frac{6}{7}$
	407	11	0
	111	16	6$\frac{6}{7}$
A's Advantage by the Rise of his Plate,	70	9	2
B's whole Advantage,	£. 41	7	4$\frac{6}{7}$

(13) 14*C.* 2*qrs.* 25*lb.* at 3*l.* 3*s.* per *Cwt.*=46*l.* 7*s.* 6$\frac{3}{4}$*d.* advance Value of A's Hops.

s. s. s.
If 59 : 63 :: 6
6

59)378(6*s*. $4\frac{3}{4}$*d*. $\frac{31}{59}$ advanced Price of B's Wine per Gallon. Now $1\frac{1}{2}$ *hhd*.$=94\frac{1}{2}$ *gal*. at 6*s*. $4\frac{3}{4}$*d*. $\frac{31}{59}$
10×9+ $4\frac{1}{2}$= $94\frac{1}{2}$

B's Wine comes to 30 5 $5\frac{1}{4}$*d*. $\frac{9}{59}$
A's Hops 46 7 $6\frac{1}{2}$

Anſw. £. 16 2 $1\frac{1}{4}$*d*. $\frac{50}{59}$

25. LOSS and GAIN.

6*d*. | $\frac{1}{40}$ | 240 at 14*s*. 6*d*.
7
168
6
Coſt £. 174 Anſ.

240 at 18*s*.
9
216,0 Sold for.
174 Coſt.
£. 42 Gained.

(2) Firſt, 9*C*. 2*qrs*. 18*lb*. = 1082*lb*. and 46*l*.+12*l*. 12*s*. =58*l*. 12*s*. or 1172*s*. ſold for; therefore,
1082)1172(1*s*. $0\frac{3}{4}$*d*. $\frac{1074}{1082}$ per *lb*. the Anſwer.

(3) Firſt, 10*s*. 6*d*.—8*s*. 6*d*.=2*s*. Gain by 8*s*. 6*d*.—then
s. d. s. £.
If 8 6 : 2 :: 100 or,
As 17 *ſix-d*. : 2*s*. :: 4000 *ſix-d*. : 470*s*. 7*d*. $\frac{1}{17}$
Or, 23*l*. 10*s*. 7*d*. $\frac{1}{17}$ the Anſwer.

(4) Firſt, 100*l*.+8=108*l*. Amount; then
s. s. d.
If 5 : 108 :: 6 3 then 135—100=35*l*. Anſwer.
20 25 25 Threepences.

Mr. Webster's Anſwer is 10*l*.

2,0)270,0(135*l*.

(5) Firſt, 100+7*l.* 10*s.*=107*l.* 10*s.* Amount.
s. £. *s.* *s.* *d.*
If 5 : 107 10 :: 5 9 Or,
As 20*three-d.* : 2150*s.* :: 23*three-d.* : 24725=123*l.* 12*s.* 6*d.* Amount per Cent.
Then 123*l.* 12*s.* 6*d.*—100=23*l.* 12*s.* 6*d.* the Anſwer.
Mr. STONEHOUSE's Anſwer is 8*l.* 12*s.* 6*d.*

(6) Firſt, 100+15=115*l.* Amount ; then,
If 11*s.* 6*d.* : 115 :: 12*s.* Or,
As 23*ſix-d.* : 115*l.* :: 24*ſix-d.* : 120*l.* the Amount per Cent.
Therefore 120—100=20*l.* per Cent. Anſwer.
Mr. HILL makes the Anſwer 15*l.* 13*s.* 0½*d.* $\frac{2}{23}$

(7) 3*d.* | ¼ | 500 at 1*s.* 3*d.* Now 100—9=91*l.* or 1820*s.* then
125 *s.* £. *s.*
—— £. *s.* If 1820 : 100 :: 625
625*s.*=31 5
—— 182,0)6250,0(34*l.* 6*s.* 9¼*d.* $\frac{6}{182}$ Amt.
Therefore 34*l.* 9*s.* 6¾*d.* $\frac{3}{91}$—31*l.* 5*s.*=3*l.* 1*s.* 9¾*d.* $\frac{3}{91}$ the Anſwer.
Mr. DILWORTH's Anſwer is 2*l.* 16*s.* 3*d.*

(8) Firſt, 100+25=125£. Amount ; then,
As 6*l.* 15*s.* : 125 :: 8*l.* : 148*l.* 2*s.* 11½*d.* $\frac{2}{9}$ Amount per Cent.
Then 148*l.* 2*s.* 11½*d.* $\frac{2}{9}$—100=48*l.* 2*s.* 11½*d.* $\frac{2}{9}$ the Anſwer.
Mr. WALKINGHAM's Anſwer is 29*l.* 12*s.* 7*d.* $\frac{8}{9}$

(9) Firſt, 100+30=130*l.* Amount ; then,
As 3*l.* 10*s.* : 130*l.* :: 4*l.* 5*s.* : 157*l.* 17*s.* 1½*d.* $\frac{6}{7}$ Amt. per Cent.
Then 157*l.* 17*s.* 1½*d.* $\frac{6}{7}$—100=57*l.* 17*s.* 1½*d.* $\frac{6}{7}$ Anſwer.

(10) Firſt, 100—27=83*l.* and 100+20=120*l.* then,
£. £. £. *s.* £. *s.*
If 83 : 100 :: 52 10 : 63 5 $\frac{5}{83}$
£. £. £. *s.* £. *s.* *d.*
Again, A 100 : 120 :: 63 5$\frac{5}{83}$: 75 18 0¾ $\frac{49}{83}$ Worth.
Sold for 52 10 0
Anſwer, £.23 8 0¾ $\frac{49}{83}$

(11) 112*lb.* at 2*s.* 11*d.* $\frac{2}{3}$=16*l.* 12*s.* 10*d.* $\frac{2}{3}$ ſold for at Turky.

Then 16*l.* 12*s.* 10*d.*$\frac{2}{3}$÷2=8*l.* 6*s.* 5*d.* $\frac{1}{3}$ coſt him.

Therefore, from 8*l.* 6*s.* 5*d.* $\frac{1}{3}$, take 8*l.* Rem. 6*s.* 5*d.* $\frac{1}{3}$ Loſs, the Anſwer.

(12) Firſt, 4*s.* 3*d.*+2*d.*=4*s.* 5*d.* prime Coſt and Charges.

s. *d.* *s.* £. *s.* *d.*
Then—As 4 5 : 6::100 : 2716 11$\frac{3}{4}$ $\frac{5}{53}$
Again, 100—12=88*l.*
£. £. *s.* *d.*
Alſo—If 100 : 88::2716 11$\frac{3}{4}$ $\frac{5}{53}$
£. *s.* *d.*
Or, as 5088000 : 88::6912000 : 119 10 11$\frac{1}{4}$ $\frac{15}{53}$ Amt.

Then, 119*l.* 10*s.* 11$\frac{1}{4}$*d.* $\frac{15}{58}$—100=19*l.* 10*s.* 11$\frac{1}{4}$*d.* $\frac{15}{53}$, gained per *lb.* the Anſwer.

(13) Firſt, 800×14=11200*lb.* at 12$\frac{1}{2}$*d.* per *lb.*

Then 11200×12$\frac{1}{2}$=140000*d.* Value of the Anchovies: which÷by 749,0, gives 18$\frac{1}{2}$*d.* $\frac{574}{749}$ Amount of 12$\frac{1}{2}$*d.*

Again, 100+17=117*l.* Amount; then,
£. £. *d.*
If 117 : 100 : : 18$\frac{1}{2}$ $\frac{574}{749}$
Or, As 84127680 : 100 : : 5542900 : 1*s.* 3$\frac{1}{4}$*d.* $\frac{2085256}{8412765}$, the Anſwer.

(14) Firſt, 41*l.* 3*s.* 4*d.*=9880*d.* and 3*s.* 1*d.*=37*d.*

Then, 9880÷37=267$\frac{1}{37}$*lb.* at 3*s.* 1*d.* per *lb.* bought.

Again, 34*l.* 2*s.* 6*d.*=8190*d.* and 4*s.* 6*d.*=54*d.*

Then, 8190÷54=151$\frac{2}{3}$*lb.* ſold at 4*s.* 6*d.* per *lb.*

Therefore, 267$\frac{1}{37}$—151$\frac{2}{3}$=267$\frac{3}{111}$—151$\frac{74}{111}$=115$\frac{40}{111}$ *lb.* Spoiled at 3*s.* 1*d.*=37*d.* ſo that 115$\frac{40}{111}$×37=4268$\frac{37}{111}$ *d.* or 17*l.* 15*s.* 8$\frac{1}{4}$*d.*$\frac{37}{111}$ prime Coſt of the Goods ſpoiled.

(15) Firſt, $\frac{3}{8}$ of 11*s.*=$3\frac{3}{8}$, or 4*s.* 1$\frac{1}{2}$*d.* gained per Thouſand, when he ſold them at 11*s.* ∵ 11*s.*—4*s.* 1$\frac{1}{2}$*d.*= 6*s.* 10$\frac{1}{2}$*d.* per Thouſand prime Coſt; then,

As 6*s.* 10$\frac{1}{2}$*d.* : 11*s.* : : 100*l.* : 160*l.* Amount of 100*l.*

Again, As 11*s.* : 160*l.* : : 13*s.* 6*d.* : 196*l.* 7*s.* 3$\frac{1}{4}$*d.* $\frac{1}{11}$ Amount per Cent. at 13*s.* 6*d.*

Then, 196*l.* 7*s.* 3$\frac{1}{4}$*d.* $\frac{1}{11}$—100=96*l.* 7*s.* 3$\frac{1}{4}$*d.* $\frac{1}{11}$ gained per Cent. the Anſwer.

£. | £. s. d.
(16) 5 | $\frac{1}{20}$ | 500 16 8 at $6\frac{1}{2}l.$ per Cent.
1 | $\frac{1}{5}$ | 25 0 10 }
$\frac{1}{2}$ | $\frac{1}{2}$ | 5 0 2 } C's Profit.
2 10 1 }

£. s. d.
Then 500 16 8—32 11 1=468 5 7 Wine coſt C.
Alſo, 468 5 7—38 11 6=429 14 1 ——— coſt B.

Again, £.20 | $\frac{1}{5}$ | 429 14 1 at $4\frac{1}{3}$ per Cent.
4 | $\frac{1}{5}$ | 85 18 $9\frac{1}{4}$ at 20 per Cent.
$\frac{1}{3}$ | $1\frac{1}{2}$ | 17 3 9 }
1 8 $7\frac{1}{4}$ } A's Profit.

Then 429*l.* 14 1—18 12 $4\frac{1}{4}$=411 1 $8\frac{1}{4}$ coſt A.
Alſo, 411*l.* 1*s.* 8*d.*=8221*s.* $8\frac{1}{4}d.$ and 15 Pipes × 126=1890 Gallons; then 1890)8221*s.* $8\frac{1}{2}d.$(4*s.* $4d.\frac{38}{189}$, per Gal. the Anſwer.

(17) Firſt, $\frac{2}{7}$ of 480*l.* 12*s.* = 137*l.* 6*s.* 3*d.* $\frac{3}{7}$, Coſt of the damaged Goods; then 137*l.* 6*s.* 3*d.* $\frac{3}{7}$—48*l.* 18*s.* = 88*l.* 8*s.* 3*d.* $\frac{3}{7}$ made of the damaged Goods.

s. *d.* *Yd.* £. *s.* *d.*
∵ As 5 6 : : 1 : : 88 8 $3\frac{3}{7}$: $321\frac{234}{422}$ Yards damaged.
$321\frac{234}{462}$ × 7=$2250\frac{252}{462}$ Yards, which ÷ 2=$1125\frac{126}{462}$ Yards bought in all.
Then $1125\frac{126}{462}$—$321\frac{234}{462}$=$803\frac{354}{462}$ Yards undamaged.
Again,—From 480*l.* 12*s.* take 88*l.* 8*s.* 3*d.* $\frac{3}{7}$ Rem. 392*l.* 3*s.* 8*d.* $\frac{4}{7}$ to be made of the undamaged Goods.

Yds. £. *s.* *d.* *Ell.*
∵ If $803\frac{354}{462}$: 392 3 $8\frac{4}{7}$: : 1
Or, As $\frac{371340}{462}$: $65887\frac{2}{7}$: : $\frac{5}{4}$: $\frac{1421994380}{10396708}$ = 12*s.* $2\frac{1}{4}d.$ $\frac{1475775}{2599177}$ per Ell.

26. ALLIGA-

26. ALLIGATION MEDIAL.

Gal. at *s.*

(1) 14 × 8 = 112
12 × 6 = 72
10 × 7 = 70
20 × 4 = 80
8 × 9 = 72
—— ——
As 64 : 406 :: 1 *Gal.* : 6*s.* $4\frac{1}{8}$*d.* the Anſw.
—— ——

Gal. at *d.* £. £. *d.* *d.*

(2) 13×80 = 1040 | If 100 : 110 :: 2600 : 11 $10\frac{1}{4}$ or 2860
20×60 = 1200 | then 2860—2600 = 260. Alſo 2600
10×36 = 360 | +260 = 2860.
— *qrs.* —— ∴ As 172 : 2860 :: 1 : $16\frac{1}{2}$*d.* $\frac{88}{172}$,
Sum 43 = 172, 2600 the Anſwer.
—— ——

27. ALLIGATION ALTERNATE.

(3) *Car.* *Car.* *Car.*

$$20\ \textit{Car.}\left\{\begin{matrix}18\\23\\19\\16\end{matrix}\right\}\quad\begin{matrix}-\\2+1+4=\\-\\-\end{matrix}\begin{matrix}3\\7\\3\\3\end{matrix}\left.\right\}\text{ of }\left\{\begin{matrix}18\\23\\19\\16\end{matrix}\right\}\text{ Carrats fine Anſwer.}$$

(4) *Car.* *lb.* *d.*

$$6d.\left\{\begin{matrix}10\\7\frac{1}{2}\\5\\4\frac{1}{2}\end{matrix}\right\}\quad\begin{matrix}-\ -\ 1\\-\ -\ 1\frac{1}{2}\\-\ -\ 4\\-\ -\ 1\frac{1}{2}\end{matrix}\left.\right\}\text{ at }\left\{\begin{matrix}10\\7\frac{1}{2}\\5\\4\frac{1}{2}\end{matrix}\right\}\text{ per } lb.\text{ Anſwer.}$$

As Examples of this Nature will admit of as many different Anſwers as there are different Ways of linking together a larger Price and a leſs than the middle or mean Rate propoſed, ſo conſequently the laſt will admit of ſeven different Ways or Anſwers.

28. ALLIGATION PARTIAL.

(5)
$$96\left\{\begin{array}{c}144\\108\\90\\78\end{array}\right\}\quad\begin{array}{c}d.\end{array}\quad \text{Diff.}\left\{\begin{array}{c}6\\18\\48\\12\end{array}\right\}\ \text{If } 6 : 36 :: \left\{\begin{array}{l}18 : 108\\48 : 288\\12 : 72\end{array}\right\}\text{ of }\left\{\begin{array}{ll}9 & 0\\7 & 6\\6 & 6\end{array}\right\}\begin{array}{l}\text{per}\\ lb.\\ \text{An.}\end{array}$$

Diff. lb. — Diff. lb. — *s. d.*

(6) *d.* — *Diff.* — *Diff. lb.* — *Diff. lb.*

$$d.\ 24\left\{\begin{array}{c}30\\20\\18\\15\end{array}\right\}\quad\begin{array}{r}4+6+9=19\\6\\6\\6\end{array}$$

If 19 : 120 :: 6 : 37 $\frac{17}{19}$, so that with 120*lb.* of the given Quantity, there must be 37 $\frac{17}{19}$*lb.* of each Sort of the other, the Answer. In all 233 $\frac{17}{19}$*lb.*

29. ALLIGATION TOTAL.

(7) — *Diff. oz.* — *Car. fine*

$$20\left\{\begin{array}{c}16\\18\\23\end{array}\right\}\quad\begin{array}{r}3\\3\\4+2=6\end{array}\ \Big|\ \begin{array}{c}\text{Sum oz.}\\ \text{If } 12 : 60 ::\end{array}\left\{\begin{array}{l}3 : 15\\3 : 15\\6 : 30\end{array}\right\}\text{ of }\left\{\begin{array}{c}16\\18\\23\end{array}\right\}\text{Answ.}$$

Sum 12 — the whole Quef. 60 oz.

(8) *s.* *Diff.* — *Diff. lb.* — *s.*

$$7s.\left\{\begin{array}{c}5\\6\\8\\9\end{array}\right\}\quad\begin{array}{c}1\\2\\2\\1\end{array}\ \Big|\ \begin{array}{c}\text{Sum oz.}\\ \text{As } 6 : 168 ::\end{array}\left\{\begin{array}{l}1 : 28\\2 : 56\\2 : 56\\1 : 28\end{array}\right\}\text{ at }\left\{\begin{array}{c}5\\6\\8\\9\end{array}\right\}\text{per } lb \text{ the Anſwer.}$$

In all 168

30. EXCHANGE.

1. With FRANCE.

(1) *Gr.* *d.* *Grs.* *d.*

As 1 : 56 :: 500 : 28000 = 116*l.* 13*s.* 4*d.* the Anſwer.

Or by Practice, thus 4*s.* $\frac{1}{5}$ 500 at 4*s.* 8*d.*

8*d.* $\frac{1}{6}$ 100

16 13 4

Anſwer, £. 116 13 4

(2) *d.* *Cr.*

As 56 : 1 :: 116*l.* 13*s.* 4*d.* = 28000

56 { 7)28000
8) 4000

Anſwer, 500 Crowns.

Cro. *d.* *Cro.* *ſol.* *din.*

(3) If 1 : 54½ :: 640 12 8

or, as 720 : 1091 :: 460952 : 69783$\frac{2}{5}$ *l.* or 145*l.* 7*s.* 7¾*d.* $\frac{4}{5}$, the Anſwer.

Or thus, by Practice.

4*s.* | $\frac{1}{5}$ | 640 at 4*s.* 6½*d.* and 12 Sols, 8 Din. at 4*s.* 6½*d.* per

6*d.* | $\frac{1}{8}$ | 128

½ | $\frac{1}{12}$ | 16

1 6 8

0 0 11½

Anſ. £.145 7 7¾ $\frac{12}{15}$ as before.

s. *d.*

10 *ſo.* | $\frac{1}{6}$ | 4 6½

2 | $\frac{1}{5}$ | 0 9 — 2 Rem.

8 *din* | $\frac{1}{3}$ | 0 1¾ — 1

0 0½ — 1

11¼ $\frac{12}{15}$

d. *Cro.* £. *s.* *d.*

(4) If 54½ : 1 :: 145 7 7½ $\frac{1}{90}$

or, as 9810 : 1 :: 6280471 : 640 *Cro.* 12 *ſol.* 8 *din.* the An.

2. With SPAIN.

d. *Piece.* £. *s.* *d.*

(5) If 56 : 1 :: 856 6 8

or, as 56 : 1 :: 205520 : 3670 Pieces, Anſwer.

P. *d.* *Piece.* *re.* *mar.*

(6) If 1 : 54¼ :: 1426 4 26

or, as 272 : 217 :: 84203378 : 309571 $\frac{66}{272}$ *qrs.* or 322*l.* 9*s.* 4¼*d.* $\frac{66}{272}$, the Anſwer.

By Practice, thus,

4*s.*	$\frac{1}{5}$	1426 at 4*s.* 6¼*d.*		
4*d.*	$\frac{1}{12}$	285	4	0
2*d.*	$\frac{1}{2}$	23	15	4
¼	$\frac{1}{8}$	11	17	8
		1	9	8½
		0	2	8¼
		£.322	9	4¼ as before.

—then for 4 *R.*, 26 *Mar.* thus,

		s.	*d.*	
4 *R.*	$\frac{1}{2}$	4	6¼	
				Rem.
17 *M.*—	$\frac{1}{3}$	2	3	—½
	$\frac{1}{2}$ $\frac{1}{4}$		3¼	½
			1½	$1\frac{3}{7}$
		2	8¼ nearly.	

3. With ITALY.

(7)	4*s.*	$\frac{1}{5}$	640 at 4*s.* 4*d.* per Dollar.		
	4*d.*	$\frac{1}{12}$	128	0	0
			10	13	4
		Answer,	£.138	13	4

(8) First, 138*l.* 13*s.* 4*d.*=33280 Pence.
Then, as 52*d.* : 1 *Dol.* : : 33280 : 640 Dollars, the Answ.

(9) 2*s.*	$\frac{1}{10}$	8644 at 3*s.* 11½*d.* per Pez.			
1	$\frac{1}{3}$	864	8		
6*d.*	$\frac{1}{2}$	432	4		
		216	2		
4	$\frac{1}{3}$	144	1	4	
1½	$\frac{1}{4}$	54	0	6	
2*s.* 6*d.*	$\frac{1}{8}$	0	0	5¾	$\frac{6}{8}$=$\frac{1}{8}$ of 47½*d.*
Answer,		£.1710	16	3¾	$\frac{6}{8}$

(10) First, 1710*l.* 16*s.* 4*d.*=821192 Half-Pence, and 47½*d.*=95 ditto.
Then—If 95 : 1 *Pez.* : : 821192 *h.* : : 8644 *Pez.* Answer.

4. With PORTUGAL.

(11)

5*s.*	$\frac{1}{4}$	4750 at 5*s.* 4*d.*		
		1190	0	0
4	$\frac{1}{15}$	79	6	8
Anſwer,	£.	1269	6	8

(12) Firſt, 1566*l.* 6*s.* 8*d.*=375920*d.*

Then—If 64*d.* : 1 *Mil.* :: 375920*d.* : 5873 *Mil.* 750 *Rees.* the Anſwer.

5. With HOLLAND, FLANDERS, and GERMANY.

(13) Firſt, 564*l.* 10*s.* 6*d.*=135486 Pence, and 34*s.* 4*d.* =412*d.*

Then, as 412*d.* : 1*l.* :: 135486*d.* : 328*l.* 16*s.* 11$\frac{3}{4}$*d.* $\frac{320}{412}$ the Anſwer.

	£.	s.	£.	.	s.	d.
(14) If	1 :	34	4 ::	328	16	11$\frac{3}{4}$

Or, as 960*qrs.* : 412*d.* :: 315695*qrs.* : 135485$\frac{1}{4}$*d.* $\frac{1}{12}$, or 564*l.* 10*s.* 5$\frac{1}{4}$*d.* $\frac{1}{12}$, the Anſwer.

By Practice, thus,

10*s.*	$\frac{1}{2}$	328 at 1*l.* 14*s.* 4*d.*		
4	$\frac{1}{5}$	164	0	
4*d.*	$\frac{1}{2}$	65	12	
		5	9	4
		1	9	1$\frac{1}{4}$
Anſwer,		£.564	10	5$\frac{1}{4}$

10*s.*	$\frac{1}{2}$	34	4
5	$\frac{1}{4}$	17	2
1	$\frac{1}{5}$	8	7
6*d.*	$\frac{1}{2}$	1	8$\frac{1}{2}$
3	$\frac{1}{2}$	0	10$\frac{1}{4}$
2	$\frac{1}{3}$	0	5
$\frac{3}{4}$	$\frac{1}{4}$	0	3$\frac{1}{4}$
		0	1$\frac{1}{4}$
	£.	1	9 1$\frac{1}{4}$

	s.	d.		£.		Guil.	Stiv.	Pen.
(15) If	33	3	:	1	::	4200	12	8
	12					20		
	399					84012		
						2		

399)168025(421*l.* 2*s.* 3$\frac{1}{2}$*d.* $\frac{270}{399}$ Anſwer.

(16)

£. s. d. £. s. d.
(16) If 1 : 33 3 :: 421 2 3
or, as 240*d.* : 399*d.* :: 101067*d.*
×399

24,0)40325733(168023*d.*

213*d.*
8

24,0)1704($7\frac{24}{240}$ *Pen.*

Now 168023÷40=4200 Guil. 11 Stiv. $15\frac{24}{240}$ Pen. the Anſwer.

(17) Firſt, 242*l.* 13*s.* 6*d.*=58242 Pence; then
4,0)5824,2(1456 Guil. 1 Stiv. the Anſwer.

6. To Change CURRENT MONEY into BANCO.

G. *£.* *G. St.*
(18) If 105 : 100 :: 495 18
20 20
G. St. Pin.
21,00)9913,00(472 5 $11\frac{9}{21}$ Anſwer.

Rem. 6
20

21)120(5 Stivers.

Rem. 15*d.*
×16

21)240($11\frac{9}{21}$ Pin.

9

G. *G.* *St.* *G.* *St.*

(19) If 100 : 105 $12\frac{1}{2}$ :: 470 8

20 20 20

2000 2112 9408

2

4225

9408

2,000)39748,800

2)19874—3 $\frac{1}{5}$ St.

20)993,2

Anſw. Guild. 496 12 3 $\frac{1}{5}$

7. With VENICE.

Du. *d.* *Du.* *ſol.* *den.*

(20) If 1 : $47\frac{6}{8}$ :: 4720 10 8

Or, as 240 : 382 :: 1128128 : $224450\frac{1}{4}$*d.* $\frac{1}{8}$, or 935*l.* 4*s.* $2\frac{1}{4}$*d.* $\frac{1}{8}$, the Anſwer.

Or by Practice thus,

$\frac{4}{8}$ $\frac{1}{2}$ | 4700 at 47 $\frac{6}{8}$; then for 10 Sol. 8 Den at

×47

220900

$\frac{2}{8}$ $\frac{1}{2}$ | 2350

1175

$25\frac{2}{3}$

12)$224450\frac{1}{4}\frac{2}{3}$

2,0)18704—2

Anſ. £. 935 4 $2\frac{1}{4}\frac{2}{3}$

St.		*d.*
5	$\frac{1}{4}$	$47\frac{6}{8}$
		—
		$11\frac{7}{8}$
4	$\frac{1}{5}$	$9\frac{4}{6}$
1	$\frac{1}{4}$	$2\frac{3}{8}$
4*d.*	$\frac{1}{3}$	$\frac{6}{8}$
4*d.*	$\frac{1}{3}$	$\frac{6}{8}$
		$25\frac{2}{8}$

8. With POLAND and PRUSSIA.

G.P. *£.* *Flor.*

(21) If 270 : 1 : 4684

Or, as 270 : 1 :: 140520 : 520*l.* 8*s.* 10*d.* $\frac{2}{3}$ Flemiſh.

Again, If 34*s.* 4*d.* : 1*l.* :: 520*l.* 8*s.* 10*d.* $\frac{2}{3}$.
Or, as 1236 Thirds : 1 :: 374720 Thirds : 303*l.* 3*s.* 5*d.* $\frac{204}{1236}$ the Anſwer.

(22) *d.* *s.* *d.*
4 | $\frac{1}{3}$ | 390 at 33 4
×33

12870
130

2,0)13000

650£. Flemiſh.

Now 270 Gros. = 9 Florins;
Then—If 1*l.* : 9 *Fl.* :: 650*l.* : 5850 Florins the Anſwer.

9. With RUSSIA.

Rub. cop.
(23) 6420 42
×100

122)642042(5262$\frac{78}{122}$ Rix dollars.
×2$\frac{1}{2}$

10525$\frac{34}{122}$
2631$\frac{39}{122}$ } Florins Current.

Fl.Cur. Fl.B.
If 103 : 100 :: 13156$\frac{73}{122}$ *Flor. Banco.*
Or, as 12566 : 100 :: 1605105 : 12773$\frac{2491}{6283}$.
Now 12773$\frac{2491}{6283}$ × 40 = 510935$\frac{5395}{6283}$ Pence, and 34*s.* 6*d.* = 414*d.*
Then—If 414*d.* : 1*l.* :: 510935$\frac{5395}{6283}$*d.*
Or, as 2601162 : 1*l.* :: 3210210000 : 1234*l.* 2*s.* 10$\frac{1}{4}$*d.* $\frac{2687964}{2601162}$, the Anſwer.

10. With IRELAND.

£. £. £. *s.* *d.*
(24) If 112 : 100 :: 740 14 6
Or, as 4480 *ſix-d* : 100 :: 29629 *ſix-d.* : 661*l.* 7*s.* 2$\frac{3}{4}$*d.* $\frac{64}{448}$, the Anſwer.

(25)

£. | £. s. d.

(25) 10 | $\frac{1}{10}$ | 651 14 $11\frac{3}{4}$ at 112 per 100
2 | $\frac{1}{5}$ | 65 3 $5\frac{3}{4}$
13 0 $8\frac{1}{4}$

Anſwer, £. 729 19 $1\frac{3}{4}$

11. With AMERICA and the WEST-INDIES.

£. £. £. s.
(26) If 164 : 100 :: 1474 16
Or, as 3280*s.* : 100 :: 29496*s.* : £.899 5*s.* $4\frac{1}{4}$*d.* $\frac{184}{328}$, the Sterling required.

£. | £. s. d.
(27) 50 | $\frac{1}{2}$ | 943 17 $5\frac{1}{4}$ at 164 per 100
10 | $\frac{1}{5}$ | 471 18 $8\frac{1}{2}$
2 | $\frac{1}{5}$ | 94 7 $8\frac{3}{4}$
2 | $\frac{1}{5}$ | 18 17 $6\frac{1}{2}$
18 17 $6\frac{1}{2}$

Anſwer, £. 1547 18 $11\frac{1}{2}$ Currency.

(28) Firſt, 100 + 30 + 5 = 135 Amount.
Then—If 135*l.* : 100*l.* :: 987*l.* 12*s.*
Or, as 2700*s.* : 100 :: 19752*s.* : 731*l.* 11*s.* $1\frac{1}{4}$*d.* $\frac{1}{2}$ remitted.
Conſigned - 640 16 9

Gained - £. 90 14 $4\frac{1}{4}$ $\frac{1}{2}$ Sterling.

£. s. d. £. s. d. £.
Therefore,—If 640 16 9 : 90 14 $4\frac{1}{4}$ $\frac{1}{3}$ :: 100
Or, as 153801*d.* : 261268 Thirds :: 24000*d.* : 14*l.* 3*s.* $1\frac{1}{4}$*d.* $\frac{2}{3}$ gained per Cent.

(29) 25 | $\frac{1}{4}$ | 1470 12 8 at $136\frac{1}{2}$ per 100
367 13 2
10 | $\frac{1}{10}$ | 147 1 $3\frac{1}{5}$
1 | $\frac{1}{10}$ | 14 14 $1\frac{2}{5}$
$\frac{1}{2}$ | $\frac{1}{2}$ | 7 7 $0\frac{3}{5}$

2007 8 $3\frac{1}{5}$

s. d. £. d.

(30) If 34 4 : 1 :: 52

Or, as 412*d.* : 240*d.* :: 52*d.* : 30*d.* $\frac{30}{103}$ for 400 Reas.

∴ 30$\frac{30}{130}$ × 2$\frac{1}{2}$ = 75$\frac{75}{103}$ Pence Sterling for 1000 Reas.

Crown.

(31) 4*s.* $\frac{1}{5}$ | 1200 at 4*s.* 7*d.* per Crown.

6*d.* $\frac{1}{8}$ | 240

1 = $\frac{1}{6}$ | 30

5

£. 275 0 0

£. s. £.

If 100 : 10 :: 275 :: 27*s.* 6*d.* Commiſſion.

Therefore 275*l.* + 1*l.* 7*s.* 6*d.* = 276*l.* 7*s.* 6*d.* = 66330*d.*

Then, as 56*d.* : 1 *Cr.* :: 66330*d.* : 1184$\frac{13}{28}$ *Cr.*

∴ 1200 − 1184$\frac{13}{28}$ = 15$\frac{15}{28}$ A.'s Gain.

d. *Sols.* *d.* *Sols.*

(32) As 67 : 32 :: 70 : 33$\frac{29}{67}$ Lubeck, per Florin.

(33) Receip.—If 54*d.* : 33*s.* 6*d.* :: 54$\frac{1}{2}$*d.*

Or, as 108 : 142 :: 109 : 398$\frac{34}{109}$*d.* = 33*s.* 2*d.* $\frac{34}{109}$ Flemiſh, the Anſwer.

£. £. s. d.

(34) If 100 : 102 :: 33 4

Or, as 6000 : 102 :: 100 : 1*l.* 14*s.* Flem. per £. Sterling.

(35) If 100$\frac{3}{20}$: 100 :: 91 : 90$\frac{1730}{2003}$ = 90$\frac{529739}{602903}$.

Alſo, 100$\frac{1}{3}$: 100 :: 93 : 92$\frac{416624}{602903}$.

Then 92$\frac{416624}{602903}$ − 90$\frac{529739}{602903}$ = 1$\frac{438357}{602903}$, Gain per Cent. for two Months; therefore 1$\frac{438357}{602903}$ × 6 = 10$\frac{218530}{602903}$ = 10*l.* 19*s.* 1$\frac{1}{4}$*d.* Gain per Cent. per Ann. the Anſwer.

(36) Firſt, 2000 × 40 = 80000 Flemiſh Pence.

Or, 160000 Half-pence, 90$\frac{1}{2}$*d.* = 181 Ditto, and 89$\frac{1}{2}$*d.* = 179.

181)160000(883$\frac{177}{181}$ } Crowns.

179)160000(893$\frac{153}{179}$ } Tournois.

Or, 104 : 100 :: 883$\frac{177}{181}$: 849$\frac{2303}{2353}$ = 849$\frac{8656977}{8844927}$.

Alſo, 105 : 100 :: $893\frac{153}{179}$: $851\frac{1091}{1759}=851\frac{2557123}{8844927}$. $851\frac{2867123}{8844927}-849\frac{8656977}{8844927}=\frac{2580833}{8844927}$=1 *Cro.* 18 *ſols.* 9*din.* in Favour of B.

31. COMPARISON of WEIGHTS and MEASURES.

Left Hand. *Right Hand.*

(1) Firſt, 100 113, Now, 100×100×60=600000
100 81, And, 113×81=9153
60

Then, 600000÷9153=65*lb.* $8\frac{7656}{9153}$, Anſwer.

(2) *lb.* *lb.*
Firſt, 104 $84\frac{1}{2}$ | Then 104×100 ×64=665600
100 108 | And 108× $84\frac{1}{2}$ =9126
64 | 9126)665600(72*lb.* $14\frac{8684}{9126}$*oz.* the Anſ.

Yds. *Ells.*
(3) 100 78 Then 100 ×78×100=7800,00
78 $133\frac{1}{3}$ And $133\frac{1}{3}$×78= =104,00
100

Alſo, 104)7800(75 Yards, the Anſwer.

Canes. *Ells.*
(4) 100 $191\frac{1}{3}$ Then 78×100×100=780000
78 $131\frac{2}{3}$ And $191\frac{1}{3}\times131\frac{2}{3}=\frac{226730}{9}$
100 Alſo $780000\div\frac{226730}{9}=\frac{76200000}{226730}=30\frac{4}{5}$ Canes, nearly the Anſwer.

lb. *lb.*
(5) 100 92 Then 92×110×60=607200
100 110 And 100×100=10000
60

Alſo, 1,0000)60,7200($60\frac{18}{25}$*lb.* the Anſwer.

Yds. *Bra.*
(6) 74 100 Then 100×100×30=300000
100 30 And 74×100=7400
100 Alſo 74,00)300000($40\frac{2}{37}$ Canes, the Anſw.

32. SINGLE POSITION.

(1) Suppoſe A's Age to be 20
Then B's will be 20+10=30
And C's will be 30× 2=60

Sum 110

As 110 : 20 :: 132 : 24 A.'s Age.
Then 24+ 12=36 B.'s
And 36× 2=72 C.'s

Sum 132 Proof.

(2) Suppoſe ſhe had 10
Then as many 10
One half as many 5

Sum, 25, for 12+12+6+10=40 Proof.

Then 40—10=30
As 25 : 10 :: 30 : 12 her Flock, the Anſwer.

(3) Suppoſe C's Age to be 10
A's. ∴ 10+ 4 =14
And B's 10+14+9=33

Sum 57—17=40

Then 4+4+9=17.
And 45—17=28.

As, 40 : 10 :: 28 : 7 C.'s Age.
7 C's Age.
And 7+4=11 A's.
Alſo 7+11+9=27 B's.
7 C's.
Proof, 45 D's.

(4)
Miles.
Suppoſe Andrew goes - - 30
Then Ben. will go $\overline{30\times3}$+ 3= 93
And Chriſtopher 93×2+16= 202

Sum, 325

469
—25

444

Then $\overline{3\times2}$+3+16=25

As

M. *M.* *M.* *Miles.* 300 *Diff.*
As, $\overline{300 : 30} :: 444 : 44\frac{2}{5}$ Andrew.
Alſo $\overline{44\frac{2}{5}\times 3} + 3 = 136\frac{1}{5}$ Benjamin.
And $\overline{136\frac{1}{5}\times 2} + 16 = 288\frac{2}{5}$ D. Christopher.

Proof, 469

(5)

	£.	s.	£.	s.
Suppoſe A. paid	200	0	45	15
Then B. $\overline{200\times 3\frac{1}{2}}-45$l. 15s.=	654	5	×	2
And C. 200+654 5+26 10=	880	15		
			91	10
Sum,	1735	0	26	10
		Difference	65	0

Now 2000+65=2065, and 65+1735=1800

£. £. £. £. s.
Then—As $\overline{1800 : 200} :: 2065 : 229$ $8\frac{8}{9}$ A.
∴ $\overline{229\ 8\frac{8}{9}\times 3\frac{1}{2}}-45$ 15= 757 $6\frac{1}{9}$ B. paid.
And 229 $8\frac{8}{9}$+757 $6\frac{1}{9}$+ 26 10=1013 5 C.

Proof, 2000 0

(6) Suppoſe they will empty the Ciſtern in 30 Minutes, then the firſt will empty $\frac{1}{2}$ or 30 Pipes.
The ſecond - $\frac{1}{4}$ or 15
And the third - $\frac{1}{6}$ or 10

Sum, 55

Gal. *Min.* *G.* *M.* *Sec.*
∴ As 55 : 30 :: 60 : 32 $43\frac{1}{11}$, the Time ſought.

(7) Firſt, $\frac{1}{4}$ of $\frac{1}{2}=\frac{3}{8}$
Suppoſe he had 240, then $\overline{240\div 8}\times 3=90$
∴ As $\overline{90 : 240} :: 900 : 2400$ Men, the Anſwer.

Or, thus, $900\div\frac{3}{8}=\frac{7200}{3}=2400$ Men, as before.

(8) Suppoſe he had 12 | If 37 : 12 :: 333
Then as many 12 | 333
½ as many 6 | ———
⅓ Ditto 4 | 37)3996(108 Scholars, the Anſwer.
¼ Ditto 3 |

Sum 37

33. DOUBLE POSITION.

(1) £.

Suppoſe the Value of the firſt Horſe to be 20
To which add the Value of the Saddle 50

2)70 Double the Val. of the Second.

Then the Value of the Second is 35
To which add the Value of the Saddle 50

The Sum ſhould have been triple the Value of the firſt Horſe } 85=25 too much.

£.
Again, Suppoſe the firſt Horſe to be worth 24
Then proceeding as above 50

2)74

Alſo the Value of the ſecond is 37
50

87=15 too much.

Sup. Er.
20 × 25 Then 25−15=10 Difference of Errors.
24 15 Alſo 600−300=300 the Difference of the Prod.

600 300 ∴ 300÷10=30 the Value of the firſt Horſe.

£30 Value of the firſt Horſe.
50 Value of the Saddle.

2)80 Double the Value of the ſecond Horſe.

£. 40

£. Brought over.
40 Value of the ſecond Horſe.
50 Value of the Saddle.

Proof, 90=30×3=90

(2)

Suppoſe he had 8
Then 8+ 8=16
Alſo, 16— 6=10
10+10=20
20— 6=14
14+14=28
28— 6=22
too much.

Again, ſuppoſe he had 7
Then 7+ 7=14
14— 6= 8
8+ 8=16
16— 6=10
10+10=20
20— 6=14
too much.

Sup. *Er.*

8	×	22
7		14
154		112

Then 22—14=8, and 154—112=42
∴ 42÷8=$5\frac{1}{4}$*d.* the Anſwer.

(3)

Crs.

Suppoſe - 28 A's
Then 28+16 : =44 B's
And 28+44÷6=12 C's
Sum, 84=28
too little.

Again, ſuppoſe A had 34
Then B 44+16=50
C 84÷ 6=14
Sum, 98=14
too little.

Sup. *Er.*

28	×	28
34		14
952		392

Then 952—392=560, and 28—14=14 Diff. of Errors.
∴ 14)560(- 40 A's
And 40+16 = 56 B's
Alſo 40+56(96)÷6=16 C's
} Crowns.

(4) Suppoſe he had 60
Tom took 30—10=20
Rem. 40
Ned took 20—4=16
Rem. 24
Jack took 12—1=11
Rem. 13=5
too little.

Again, ſuppoſe he had 76
Then 38—10=28
Rem. 48
24—4=20
Rem. 28
14—1=13
Rem. 15=3
too little.

Sup.

Sup.		*Er.*	
60	×	5	Then $380-180=200$, and $5-3=2$
76		3	∵ $200\div2=100$, what he had at firſt.
380		180	

(5) Suppoſe the Father's Age to be 40
Then the Son will be $40\div5=$ 8
And 4 Years ago was $8-4=$ 4
which is 12 too little.

Again, ſuppoſe the Father was 60
Son will be $60\div5=$ 12
And 4 Years ſince was $12-4=$ 8, which is 4
too little.

Sup.		*Er.*	
40	×	12	Then $720-160=560$, and $12-4=8$ ∵ $560\div8=70$ Years, the Father's Age; and $70\div5=14$ the Son's.
60		4	
720		160	For $14-4=10=\frac{1}{7}$ of 70 (the Age of the Son 4 Years ago) and $14\times5=70$, the Proof.

(6) Suppoſe the Body to be 24 Inches.

Then $\overline{24\div2}+9=21$ Tail; alſo $21+9=30$, which is 6 too much.

Again, ſuppoſe the Body to be 26, then $\overline{26\div2}+9=22$ Tail; alſo $22+9=31$, which is 5 too much.

Sup.		*Er.*	
24	×	6	Then $156-120=36$, and $6-5=1$
26		5	∴ 36 Inches is the Length of the Body.
156		120	And $\overline{36\div2}+9=27$ Tail. Therefore $36+27+9=72$ Inches, the Anſw.

(7)

Suppoſe the No. to be	4	Again, ſuppoſe the No. to be	5
Then $4+4=$ -	8	Then $5+5=$ -	10
And $8\times4=$ -	32	And $10\times5=$ -	50
Alſo $32-4=$ -	28	Alſo $50-5=$ -	45
Likewiſe $28\div4=$	7	$45\div5=$ -	9
Therefore $13-7=$	6	$13-9=$ -	4
too little.		too little.	

Brought over.

$$\begin{array}{ccc} \textit{Sup.} & & \textit{Er.} \\ 4 & & 6 \\ & \times & \\ 5 & & 4 \\ \hline 30 & & 16 \\ \hline \end{array}$$

Then 30−16=14, and 6−4=2.
∴14÷2=7, the Number ſought. For
$\overline{7+7}\times 7-7=91$, which ÷7=13, the Proof.

(8)

Suppoſe ſhe	14	Again, ſuppoſe ſhe	16
Then he 14×3=42		Then he will be 16×3=48	
14+10+5=	29	16+10+5=	31
42+10+5=	57 }	48+10+5=	63 } ſub.
29× 2	58 }	31× 2	62 }
too little by	1	too much by	1

$$\begin{array}{ccc} \textit{Sup.} & & \textit{Er.} \\ 14 & & 1 \\ & \times & \\ 16 & & 1 \\ \hline 16 & & 14 \\ \hline \end{array}$$

Then 16+14=30, and 1+1=2
∴ 30÷2=15 Years, her Age.
And 15×3=45 his, Anſwer. For
15+10+5=30 her, when married 15 Years.
And 45+10+5=60 his, ————
For as 8 : 16 : : 30 : 60 Proof.

(9)

	Beg.	*Beg.*		*Beg.*	*Beg.*
Sup.	8	8	Again, ſuppoſe	10	10
	×4	×6		×4	×6
	32	48		40	60
	+16	−12		×16	−12
	48 ——	36=		56	−48=8 too
12 too little					little.

$$\begin{array}{ccc} \textit{Sup.} & & \textit{Er.} \\ 8 & & 12 \\ & \times & \\ 10 & & 8 \\ \hline 120 & & 64 \\ \hline \end{array}$$

Then 120−64=56, and 12−8=4∴56÷4=
=14, the Number of Beggars. For 14×4+16
$=\overline{14\times 6}-12=72$*d.* what he gave, Proof.

(10) Pro-

(10)

Suppoſe the Number to be 15
Then $15 \times 3 = 45$
And $45 - 5 = 40$
Alſo $40 \div 2 = 20$
$20 + 15 = 35$
$40 - 35 = 5$
too little

Again, ſuppoſe 25
Then $25 \times 3 = 75$
And $75 - 5 = 70$
Alſo $70 \div 2 = 35$
$35 + 25 = 60$
$60 - 40 = 20$
too much.

Sup. *Er.*

$$\begin{array}{ccc} 15 & & 5 \\ & \times & \\ 25 & & 20 \\ \hline 125 & & 300 \end{array}$$

Then $125 + 300 = 425$, and $20 + 5 = 25$.
$\because 425 \div 25 = 17$, the Number required.
For $17 \times 3 - 5 = 46$, and $46 \div 2 + 17 = 40$ Proof.

(11)

Suppoſe B had 6
Then A muſt have 4
For $6 - 1 = 4 + 1 = 5$
Again $4 - 1 = 3$
And $6 + 1 = 7$
Alſo, $3 \times 2 = 6$
$7 - 6 = 1$ too lit.

Again, ſuppoſe B had 8
Then A muſt have 6
For $8 - 1 = 6 + 1 = 7$
Again, $6 - 1 = 5$
And $8 + 1 = 9$
Alſo, $5 \times 2 = 10$
$10 - 9 = 1$, too much.

Sup. *Er.*

$$\begin{array}{ccc} 6 & & 1 \\ & \times & \\ 8 & & 1 \\ \hline 8 & & 6 \end{array}$$

Then $8 + 6 = 14$, and $1 + 1 = 2 \because 14 \div 2 = 7$ B's. Guineas, and 5 A's; for $7 - 1 = 5 + 1 = 6$ A's. when he had received 1 of B. Alſo, $\overline{5 - 1} \times 2 = 7 + 1 = 8$ B's, when he had received 1 of A's. Proof.

(12)

Suppoſe Father's Age 37
Then $37 - 5 = 32$
And $32 \div 8 = 4$
$\because 4 \times 3 = 12$ Son's Age
Then $12 + 2 = 14$
And $14 \times 3 = 42$
Alſo, $42 - 7 = 35$
$\because 37 - 35 = 2$ too little.

Again, ſuppoſe Father's 45
Then $45 - 5 = 40$
And $40 \div 8 = 5$
$\because 5 \times 3 = 15$ Son's Age.
Then $15 + 2 = 17$
And $17 \times 3 = 51$
Alſo, $51 - 7 = 44$
$\because 45 - 44 = 1$ too little.

Sup-

Sup.		*Er.*
37	×	2
45		1
90		37

Then $90-37=53$, and $2-1=1$ $\because$ 53 is the Father's Age; then $53-5=48$, and $48\div8=6=\frac{1}{3}$ of the Son's Age. $\therefore 6\times3=18$, the Son's Age.

(13)

	£.
Suppoſe B had	360
Then $\overline{360\div3}\times2$ =	240
And $1200-240$ =	960 A's
Then $\overline{960\div4}\times3$ =	720
And $360+720$ =	1080 A's and B's.
$\because$ $1200-1080$ =	120 too little.

	£.
Again, ſuppoſe B had	420
Then $420\div3\times2$	= 280
And $1200-280$	= 920 A's.
Then $920\div4\times3$	= 690
And $420+690$	= 1110
$\because$ $1200-1110$	= 90 too little.

Sup.		*Er.*
360	×	120
420		90
50400		32400

Then $50400-32400=18000$ And $120-90=30$ $\because$ $18000\div30=600$£. B's Money; and $\overline{600\div3}\times2=400$. Alſo $1200-400=800$*l.* A's Money, the Anſwer.

For $600+\overline{800\div4}\times3=800+\overline{600\div3}\times2=1200$, the Proof.

(14) *greater.* *leſſer.* *gr.* *leſſ.*

Suppoſe 28 and 22
$28\div7=4$ Alſo $22\times3=66$
$4+66=70$, then $70-50=20$ too much.

Again, ſuppoſe 42 and 8
$42\div7=6$; alſo $8\times3=24$,
$6+24=30$ $\because$ $50-30=20$ too little.

Sup.		*Er.*
28	×	20
42		20
840		560

Then $840+560=1400$, and $20+20=40$ $\therefore$ $1400\div40=35$, the greater Number: and $50-35=15$ the leſſer; for $\overline{35\div7}+\overline{15\times3}=50$, the Proof.

(15) Suppoſe he worked 140 Days, ∵ 390—140=250 Days he was idle.

Then 140×12=1680 }
And 250× 8=2000 } Subt.=320 too little.

Again, ſuppoſe he worked 150 Days, ∵ 390—150=240 Days idle.

Then 150×12=1800 }
And 240× 8=1920 } Subt.=120 too little.

Sup.		*Er.*
140	×	320
150		120
48000		16800

Then 48000—16800=31200
And 320—120=200∵31200÷200=156 Days worked, and 390—156=234 Days idle, the Anſwer.
For 156×12=234×8=1872 Proof.

(16)

Suppoſe his Age was 24
Then $\overline{24\div3}\times2\times4=64$
And 64+12+50 =126
Then 126—100 =26
And 100—24 =76
∵76—26=50 too little.

Suppoſe he was 30
Then $\overline{30\div3}\times2\times4=80$
And 80+15+50 =145
Then 145—100 =45
And 100—30 =70
∵70—45=25 too little.

Sup.		*Er.*
24	×	50
30		25
1500		600

Then 1500—600=900, and 50—25=25∴ 900÷25=36 Years, his Age required.
For $36\,\underline{\div3\times2}\times\underline{4+}\,18+50-100=164-100=64$ Proof.

(17) £.

Suppoſe the firſt Horſe to be worth 24
Then the Trappings muſt be 50—24 =26
And the ſecond Horſe muſt be 24+26=50
Now 50+26=76, and 24×2=48; alſo 76—48=28, too little.

Again, ſuppoſe the firſt Horſe to be worth 28
Then the Trappings muſt be 50—28 =22
And the ſecond Horſe muſt be 28+22 =50
Now 50+22=72, and 28×2=56; alſo, 72—56=16, too little.

Sup.		*Er.*
24	×	28
28		16
784		384

Then 784—384=400
And 28—16=12 ∴ $400\div12=33\frac{1}{3}$£. Value of the firſt Horſe; and $50-33\frac{1}{3}=16\frac{2}{3}$£. Value of the Trappings.
Alſo, $33\frac{1}{3}+16\frac{2}{3}=50$£. Value of the ſecond Horſe, for $50+16\frac{2}{3}=33\frac{1}{3}\times2=66\frac{2}{3}$ the Proof.

(18)

	£.
Suppoſe he left	5000
Intereſt for 11 Years	=2750
Amount	7750
Education, &c. 100×11=	1100
Neat	6650

∵ 7400—6650=750 too little.

	£.
Again, ſuppoſe he left	6000
Intereſt for 11 Years	3300
Amount	9300
Education, &c. 100×11=	1100
Neat	8200

∵ 8200—7400=800 too much.

Sup.		*Er*
5000	×	750
6000		800
4500000		4000000

Then, 4500000+4000000=8500000 and 750+800=1550 ∴ 8500000 ÷ 1550=5483£. 17*s.* 5*d.* $\frac{2}{31}$, the Anſwer required.

34. ARITHMETICAL PROGRESSION

(1) Firſt, 1+24=25 Sum of the Extremes.
Then per Rule I. $\overline{25\times24}\div2=300$ Strokes, the Anſwer; or per Rule II.d. 25×12=300.

(2) Thus, $\overline{1+12}\times6=13\times6=78$ Strokes, the Anſwer.

(3) Firſt 2+188=190 Sum of the Extremes.
And 94÷2=47 = half the Number of Terms.
Product 8930 Feet, a Mile = 5280 Feet.
Then 5280)8930(1 Mile, 5 Fur. 21 P. $3\frac{1}{2}$ Feet, the Anſwer.

(4) Firſt 2 + 200 =202 Sum of the Extremes.
And 100÷2= × 50 half the Numb. of Terms.
A mile=yds. 1760)10100(5m. 5fur. 36p. 2yds. the Anſwer.

(5) Firſt 9£. 19s. =199 Shillings.
Then 1+199 =200 Sum of the Extremes.
And 100÷2 × 50 half the Number of Terms.
2,3)1000,0(500£. the Anſwer.

(6) Here 43—5=38 Difference of the Extremes.
And 20—1=19 Number of Terms, leſs one.
Then 38÷19=2 common Difference.
Which added to the Age of the youngeſt, and ſo on to the reſt, will give their ſeveral Ages, viz. 5+2=7 Age of the Second.
And 7+2=9 Age of the third, and ſo on for the reſt.

(7) Firſt 60—6=54 Difference of the Extremes.
Then 19—1=18 Number of Terms, leſs one.
Then 54÷18= 3 the common Difference ſought.
Then 3 added to 6 and every other Term reſpectively, gives each Day's Journey as follows, 6+9+12+15+18+21+24+27+30+33+36+39+42+45+48+51+54+57+60=627 Miles from London.

(8) Firſt 50—5=45 Difference of the Extremes.
Then 10—1=9 Number of Terms, leſs one.
Then 45÷9=5 common Difference.
Then each Payment and the whole Debt will be as follow, viz. 5+10+15+20+25+30+35+40+45+50=275£. the whole Debt.

(9) Firſt, 43—5=38 Difference of the Extremes.
Then 38÷2=19 Number of Terms, leſs one.
∴ 19+1=20 Children he had.

(10) Firſt 60—6=54 Difference of the Extremes.
And 54÷3=18 ∴ 18+1=19 Days, the Anſwer.

(11) Firſt 19—1=18 Number of Terms, leſs one.
Then 18×3 (the common Diff.=54.
And 60—54=6, the firſt Day's Journey.

(12) Firſt 10—1=9 Number of Terms, leſs one.
And 9×2=18. Then 23—18=5, the Anſwer.

(13) Firſt, 275÷10=27£. 10s.
And 10—1=9, alſo 9×5=45, which÷2=22£. 10s.
Then from 27£. 10s. take 22£. 10s.
Remains 5£. Q. E. F.

(14) Firſt 100÷2=50 what each travelled.
And 50÷5=10. Alſo 5−1=4. Then 4×2=8. Likewiſe 8÷2=4∵10−4=6 his firſt Day's Journey, and 6+2=8 the 2d. 10 the 3d. 12 the 4th, and 14 the 5th. Sum of which =50.

Again, 4)50($12\frac{1}{2}$. Alſo 4−1=3. Then 3×3=9. And 9÷2=$4\frac{1}{2}$∵$12\frac{1}{2}$−$4\frac{1}{2}$=8 his firſt Day's Journey, and 8+3=11 his 2d. 14 his 3d. and 17 his 4th. Sum of which=50 Leagues.

(15) Firſt, 19×3=57. And 57−3=54. Then 54+6=60, the laſt Term required.

(16) Firſt 100×2=200. Then 200−2=198. And 198+1=199 the laſt Term required.

(17) Firſt 30×2=60. Alſo 60−2=58. Again 58+6=64. And 64×30=1920. ∵ 1920÷2=960s.=48£. due, Anſwer.

(18) Firſt 200×2÷8=50. And 50−12=38. Alſo 8−1=7. Then 38÷7=$5\frac{3}{7}$ Miles, the common Diff. required. ∵ $5\frac{3}{7}$ added to 6, and every other Term reſpectively gives for the 1ſt. 2d. 3d. 4th. 5th. 6th. 7th. and 8th.
6. $11\frac{3}{7}$. $16\frac{6}{7}$ $22\frac{2}{7}$. $27\frac{5}{7}$. $33\frac{1}{7}$. $36\frac{4}{7}$. and 44, which, added together, gives 200 Miles, Proof.

(19) Firſt 200×2=400, and 400÷9=$44\frac{4}{9}$, alſo, $44\frac{4}{9}$−4×2 (8) =$36\frac{4}{9}$ ∵ $36\frac{4}{9}$÷8=$4\frac{5}{9}$ common Difference. Then the Miles he travelled each Day will be as follows, viz.
1ſt. 2d. 3d. 4th. 5th. 6th. 7th. 8th. 9th.
4. $8\frac{5}{9}$. $13\frac{1}{9}$. $17\frac{6}{9}$. $22\frac{2}{9}$. $26\frac{7}{9}$. $31\frac{3}{9}$. $35\frac{8}{9}$. and $40\frac{4}{9}$, which added together =200, the whole Diſtance, Proof.

(20) Firſt 9×2=18 Leagues, double the Space gone each Day by the purſued, which + to the common Difference of the Purſuer's Day's Journey, viz. 2=20 the Sum from which take double the Space gone the firſt Day by the Purſuer, viz. 6=14 remain, this ÷ by the common Difference 2, gives 7 Days, the Anſwer.

(21) For A.'s Race thus,
Firſt 4+40=44, Sum of the firſt and laſt Terms. Then 44+5, half the Number of Terms=220 Yards. A's firſt Race per Prop. the firſt.

Then 901×4=3604 yds. A's firſt Term of the laſt Race.
Alſo 910×4=3640 A's laſt Term,
their Sum 7244 which × 5=36220 A's laſt Race.

Then to find his whole Ground, put 220 firſt Term. And 36220 the laſt Term, which (by Prop. 1.) is 36440×5=182200 Yards gone by A.

For B's, thus,

Firſt 11×4=44 firſt Term. And 20×4=80 laſt Term, Then 44+80=124 their Sum, which×5=620 Yards, B's firſt Race.

∵ 911×4=3644 yds. B's firſt Term of the laſt Race.
920×4=3680 — B's laſt Race.
their Sum 7324 which ×5=36620 yds. B's laſt Race.

Then 620+36620=37240 Sum of the firſt and laſt Terms.
which × 5 = 186200 Yards, gone by B.
Deduct 182200 ditto by A.
4000 Yards, common Difference.

Which added continually to each of their ſhares, ſhew that

	Yds.		Miles.	Fur.	Yds.
A in all ran	182200	=	103	4	40
B	186200	=	105	6	80
C	190200	=	108	0	120
D	194200	=	110	2	160
E	198200	=	112	4	200
F	202200	=	114	7	20
G	206200	=	117	1	60
H	210200	=	119	3	100
I	214200	=	121	5	140
K	218200	=	123	7	180
Sums	2002000	=	1137	4	0

If 2002000 : 300£. : : 182200
182200

2002,000)54660,000(27£. 6s. 0½d. $\frac{590}{1001}$ A's Part.

If 2002,000 : 300£. : : 186200
186200

	£.	s.	d.	
2002,000)55860,000	27	18	0½ $\frac{14}{1001}$	B's Part.
	27	6	0½ 590	
Common Difference		11	11¾ $\frac{25}{1001}$	

Which by continually adding to each we ſhall have

Firſt	27	6	0½	590	= A's.	
Then	27	18	0½	14	= B's.	
	28	10	0¼	439	= C's.	
	29	2	0	864	= D's.	
	29	14	0	288	= E's	Part.
	30	5	11¾	713	= F's.	
	30	17	11¾	137	= G's.	
	31	9	11½	562	= H's.	
	32	1	11¼	987	= I's.	
	32	13	11¼	411	= K's.	
Proof	300	0	0			

From London to York ſuppoſe 180 Miles, which ×4=720 Miles, twice a back.

Their Sum Total 1137 M. 4 Fur.
Diſtance of York 720

Short of the Undertaking 417½ Miles.

35. GEOMETRICAL PROGRESSION.

(1) Firſt { 0. 1. 2. 3. 4. 5. Indices.
1. 2. 4. 8. 16. 32. Terms.

Now, 5+5=10. Then 32×32=1024=10th. Term. Again 10+5=15. ∵ 1024×32=32768 Qrs. the 16th Term. As the Indices are leſs than the Terms, by one.

And 32768 Qrs. =£. 30. 2. 8. Q. E. F.

(2) Firſt { 0. 1. 2. 3. 4. 5. 6.
1. 2. 4. 8. 16. 32. 64.

Then 64×64=4096=12th. Term.
And 4096×4096=16777216=24th. Term.
Alſo 64×32=2048=5+6=11th Term.
∵ 16777216×2048=34359738368 Farthings, or 36th. Term, which reduced to Pounds, will give 35791394£. 2s. 8d. the Anſwer.

(3) Firſt { 0. 1. 2. 3. 4. 5. 6. Indices.
10. 30. 90. 270. 810. 2430. 7290. Terms.

Now $5+6=11$. Then, $2430\times7290=17714700$, which $\div$ 10 the firſt Term gives 1771470£. the eldeſt Child's Fortune.

$$\begin{array}{llllll} 0 & 1 & 2 & 3 & 4 & 5 \\ 500. & 750. & 1125. & 1687{,}5. & 2531{,}25. & 3796{,}875. \end{array}$$

(4)

$5+4=9$ Number of Terms leſs 1.

Then $3796{,}875\times2531{,}25=9610839{,}84375$.

Which $\div$ 500 the firſt Term $=$ £.19221. 13*s*. 7*d*. 125.

(5) First $\left\{\begin{array}{llllllll} 0. & 1. & 2. & 3. & 4. & 5. & 6. & \text{Indices.} \\ 1. & 2. & 4. & 8. & 16. & 32. & 64. & \text{Terms.} \end{array}\right.$

Now $5+6=11$ Number of Terms leſs 1.

Then $64\times32=2048$ laſt Term.

And $2048-1\div2-1=2047$

Alſo $2047+2048=4095$ Guineas, or £.4299 15*s*.

(6) Firſt $\left\{\begin{array}{lllllll} 0. & 1. & 2. & 3 & 4. & 5. & 6. \\ 1. & 2 & 4. & 8. & 16. & 32. & 64. \end{array}\right.$

Then $6+6+6=18$ Number of Terms leſs 1.

$64\times64\times64=262144$ laſt Term.

$262144-1\div2-1=262143$, $+262144=524287$ Farthings; or, 546£. 2*s*. $7\frac{3}{4}$*d*. what 20 Horſes came to. $\therefore$ 20)546 2 $7\frac{3}{4}$(27£. 6*s*. $1\frac{1}{2}$*d*. $\frac{7}{20}$ per Head the Anſwer.

(7) Firſt $\left\{\begin{array}{llllll} 0 & 1 & 2 & 3 & 4 & 5 \\ 2. & 6. & 18. & 54. & 162. & 486. \end{array}\right.$

Then $486\times486=236196=5+5=$ 10th Term.

And $486\times162=78732=5+4=$ 9th Term.

Product 18596183472 laſt Term.

—2 Firſt.

Ratio $3-1=2$)18596183470

9298091735 this added to the laſt Term gives

1,00)27894275207 the Sum of all the Terms at $\frac{1}{4}$ per 100.

Value of the Pins $27894275\frac{2}{4}\frac{7}{100}$ Qrs. = 290565 7 4

Lace comes to £.8 1. $8\times5\times4$ (20) = 161 13 4

Anſwer gained 29043 14 0

(8) 0 1 2 3 4 5
10. 100. 1000. 10000. 100000. 1000000
Then 1000000×1000000=1000000000000
—10

10 Ratio——=9)999999999990
Pints.
768,0)11111111111,0(14467592$\frac{455}{768}$
A Buſhel = pts. 64)14467592(226056 $\frac{1}{8}$ Buſhels at 4*s.*
226056$\frac{1}{8}$
2 See Caſe 4. P. 85. G.

45211.4—
6 $\frac{1}{8}$ of 4*s.*

Anſwer, £. 45211.6

(9) Firſt 4. 2, 1. $\frac{1}{2}$, $\frac{1}{4}$, and ad infinitum.
Then 4×4=16 Square of the firſt Term.
And 16÷2=8 Leagues, the Anſwer.

(10) Firſt 12×12=144 Square of the firſt Term.
And 12—10=2 Difference of the firſt and ſecond Term.
Then 2)144(72 Miles, the Anſwer.

36. PERMUTATION.

(1) Firſt 1×2×3×4×5×6×7=5040 Days.
Then 365)5040(13 Years, 295 Days, the Anſwer.

(2) Firſt 1×2×3×4×5×6×7×8×9×10×11×12=
479001600 Rounds. Which×3=1437004800 Se.
And in a Year there
are 315576,00)1437004800(45 Years.

A Day = 864,00)169848,00(96 Days.

An Hour = 36,00)504.00(14 Hours.
45 Years, 96 Days, 14 Hours, the Anſwer.

(3) Firſt 1×2×3×4×5×6×7×8×9=362880 Days.
And 20 Guineas =5040 Pence.
Then, as 362880 Days : 5040*d.* :: 365 D. : 5$\frac{315}{4536}$ d. per Year.

38. REDUCTION OF VULGAR FRACTIONS.

CASE I.

(1) 336)896(2

224)336(1

112)224(2

...

Then 112)$\frac{336}{896}$(=$\frac{3}{8}$, the Term required.

(2) 2832)12848(4 Then 16)$\frac{2832}{12848}$(=$\frac{177}{803}$ the Anſwer.

1520)2832(1

1312)1520(1

208)1312(

64)208(3

16)64(4

(3) 144)560(3 Then 16)$\frac{144}{560}$(=$\frac{9}{35}$ the Anſwer.

128)144(1

16)128(8

(4) 192)336(1 Then 48)$\frac{192}{336}$(=$\frac{4}{7}$ the Anſwer.

144)192(1

48)144(3

(5) 1476)1938(1 Then 6)$\frac{1476}{1938}$(=$\frac{246}{323}$ the Anſwer.

462)1476(3

90)462(5

12)90(7

6)12(2

(6) Thus $\frac{12|000}{27|000}$ becomes $\frac{19}{27}$ Terms required.

(7) $6)\frac{42|00}{54|00}(=\frac{7}{9}$ the Anſwer.

(8) Thus $8)\frac{24}{112}(=\frac{3}{14}$ $12)\frac{96}{324}(=\frac{8}{27}$ $12)\frac{60}{144}(\frac{5}{12}$
And $12)\frac{120}{360}(=\frac{1}{5}$
Anſwer, $\frac{3}{14}$, $\frac{8}{27}$, $\frac{5}{12}$, and $\frac{1}{3}$, the Fractions required.

CASE II.

(9) Thus $\frac{4}{9}\times\frac{5}{7}\times\frac{9}{10}=\frac{18,0}{63,0}$ or $=\frac{2}{7}$ the Fraction.

Or thus $\frac{4}{9}$ of $\frac{5}{7}$ of $\frac{\cancel{9}}{10}=\frac{2}{7}$ as before.

(10) Thus $\frac{2}{9}\times\frac{3}{4}\times\frac{4}{1}=\frac{24}{36}$ or $\frac{2}{3}$, the Fraction required.

Or thus $\frac{2}{\cancel{9}}$ of $\frac{\cancel{3}}{4}$ of $\frac{\cancel{4}}{1}=\frac{2}{\cancel{3}}$ as before.

(11) Thus $\frac{3}{7}\times\frac{1}{3}\times\frac{7}{8}=\frac{21}{163}$ or $\frac{1}{8}$, the Fraction required.

Or thus $\frac{\cancel{3}}{\cancel{7}}$ of $\frac{1}{\cancel{3}}$ of $\frac{\cancel{7}}{8}=\frac{1}{8}$ as before.

CASE III.

(12) Thus $\frac{12}{1}$, $\frac{27}{1}$, and $\frac{176}{1}$, the Fractions required.

(13) Thus $\underline{27\times12}=324$, Then $\frac{324}{12}$, the Fraction required.

(14) Thus $\underline{7\times4}+2=30$. Then $\frac{30}{7}$, the Fraction required.

(15) Thus $\underline{16\times2}+1=33$. Then $\frac{33}{2}$, the Fraction required.

(16) Thus $\underline{142\times23}+17=3283$. Then $\frac{3283}{23}$, the Anſwer.

(17) Thus $146\times37+21=5423$. Then $\frac{5423}{37}$, the Anſwer.

CASE IV.

(18) Thus $30 \div 7 = 4\frac{2}{7}$, the Anſwer.

(19) Thus $33 \div 2 = 16\frac{1}{2}$, the Anſwer.

(20) Thus $3283 \div 23 = 142\frac{17}{23}$, the Anſwer.

(21) Thus $5423 \div 37 = 146\frac{21}{37}$, the Anſwer.

CASE V.

(22) $\frac{3}{4}$, $\frac{11}{12}$, and $\frac{7}{10}$

$$\text{First}\left\{\begin{array}{l}3\times12\times10=360\\11\times4\times10=440\\7\times12\times4=336\end{array}\right\}\text{New Numerators.}$$

And $4\times12\times10=480$ Common Denominator.

Anſwer $\frac{360}{480}$, $\frac{440}{480}$, and $\frac{336}{480}$.

(23) Firſt, $\frac{1}{6}$ of $\frac{7}{8}=\frac{7}{48}$. $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{7}{48}$.

$$\text{Then}\left\{\begin{array}{l}1\times4\times5\times48=960\\1\times3\times5\times48=720\\1\times3\times4\times48=576\\7\times5\times4\times3=420\end{array}\right\}\text{New Numerators.}$$

And $3\times4\times5\times48=2880$ Common Denominator.

Anſwer $\frac{960}{2880}$, $\frac{720}{2880}$, $\frac{576}{2880}$, and $\frac{420}{2880}$.

$\frac{1}{2}$. $\frac{1}{3}$. $\frac{1}{4}$. $\frac{1}{5}$ and $\frac{1}{6}$.

(24) First $1\times3\times4\times5\times6=360$

$$\begin{array}{r}\text{Alſo}\end{array}\left.\begin{array}{l}1\times3\times4\times5\times6=360\\1\times2\times4\times5\times6=240\\1\times2\times3\times5\times6=180\\1\times2\times3\times4\times6=144\\1\times2\times3\times4\times5=120\end{array}\right\}\text{New Numerators.}$$

And $2\times3\times4\times5\times6=720$ Common Denominat.

Anſwer $\frac{360}{720}$, $\frac{240}{720}$, $\frac{180}{720}$, $\frac{144}{720}$, and $\frac{120}{720}$.

(25) Firſt $\frac{3}{4}$ of $\frac{3}{1}=\frac{9}{4}$ or $2\frac{1}{4}$.

Then we have the Fractions $\frac{5}{6}$, $\frac{7}{10}$, $\frac{3}{4}$, and $\frac{1}{4}$.

$$\text{Now}\left\{\begin{array}{l}5\times10\times4\times4=800\\7\times6\times4\times4=672\\3\times6\times10\times4=720\\1\times4\times10\times6=240\end{array}\right\}\text{New Numerators.}$$

And $6\times10\times4\times4=960$ Common Denominator.

Anſwer $\frac{800}{960}$, $\frac{670}{960}$, $\frac{720}{960}$, and $\frac{240}{960}$.

CASE VI.

(26) Thus $\frac{3}{4\times\cancel{21}}=\frac{1}{28}$, the Fraction required.

(27) Thus $\frac{1\times\cancel{20}\times12}{\cancel{620}}=\frac{12}{31}$, the Fraction required.

(28) Thus $\frac{3}{4\times4\times12\times27}=\frac{1}{1728}$, the Fraction required.

(29) Thus $\frac{\cancel{5}}{7\times12\times\cancel{20}}=\frac{1}{336}$, the Fraction required

(30) Thus $\frac{1\times21\times12\times4}{1344}=\frac{1008}{1344}$ or $\frac{3}{4}$, the Fract. req.

(31) Thus $\frac{\cancel{5}}{6\times20\times12}=\frac{1}{288}$, the Fraction required.

(32) Thus $\frac{3\times\cancel{112}}{448}=\frac{3}{4}$, the Fraction required.

(33) Thus $\frac{3}{4\times16\times16\times112}=\frac{3}{114688}$, the Fract. req.

(34) Thus $\frac{5\times\cancel{12}\times\cancel{20}}{\cancel{144}}=\frac{25}{3}$, the Fraction required.

(35) Thus $\frac{7\times\cancel{3}\times8\times40}{9}=\frac{2240}{3}$, the Fraction required.

(36) Thus $\frac{7\times4\times4}{45}=\frac{112}{45}$, the Fraction required.

(37) Thus $\frac{11}{12\times63}=\frac{11}{756}$, the Fraction required.

(38) Thus $\frac{7\times48\times8}{9}=\frac{896}{3}$, the Fraction required.

(39) Thus $\frac{7\times36}{142}=\frac{126}{71}$, the Fraction required.

(40) Thus $\frac{3}{5\times8\times36}=\frac{1}{480}$, the Fraction required.

(41) Thus $\frac{7\times7\times24\times60\times60}{142}=\frac{2116800}{71}$, the Fraction required.

(42) Thus $\frac{\cancel{10}}{11\times60\times24}=\frac{1}{1584}$, the Fraction required.

CASE VII.

(43) 367 Moidores
9×3=27
1296)9909(7*s.*
Remains 837*s.*
×12
1296)10044(7*d.*
Remains 972*d.*
×4
1296)3888(3 Qrs.
Answer 7*s.* 7¾*d.*

(44) 5 Guineas.
=21
12)105
Anſwer 8*s.* 9*d.*

(45) 5*s.*
×12
8)60
Anſwer 7½*d.*

(46) £. *s.*
3 12
×4
5)14 8
Anſwer 2 17 7 $\frac{1}{5}$

(47) 5£.
×20
7)100
Anſwer 14*s.* 3¼*d.* $\frac{5}{7}$.

(48) *lb.*
411
×12
720)4932(6 oz.
Remains 612
×20
72,0)1224,0(17dwts.
504
Anſwer 6 oz. 17 dwts.

(49) *cwt.*
7
×4
9)28
Anſwer 3qrs. 3lb. 1oz. 12$\frac{4}{9}$drs.

(50) *Tons.*
63
×20
124)1260(10 cwt.
Remains 20
×112

Brought over.
124)2240(18 lb.
1000
Remains 8
×16
124)128(1 o.
Remains 4
Anſwer 10 C. 18lb. $1\frac{1}{31}$ oz.

(53) *Acres.*
7
×4
8)28
Anſwer 3 Rds. 20 Pol.

(55) 7 Bar. B.
×36
9)152
Anſwer 28 Galls.

(56) *Chal.*
25
×36
72)900(12 Buſh.
Remains 36 Buſh.
×4
72)144(2 Pecks.
Anſwer 12 Buſh. 2 Pecks.

(51) 7
×8
8)56
Anſwer 7 Furlongs.

(52) *Ell. Eng.*
5
5
8)25
Anſwer $3\frac{1}{8}$ Qrs.

(54) *Hhd. W.*
11
×63
252)693(2 Galls.
Remains 189
×4
252)756(3 Qts.
Anſwer 2 Galls. 3 Qts.

(57) *Months.*
7
×4
8)28
Anſwer Weeks 3. 3. 12.

(58) 5 *Days.*
×24
7)120
Anſwer Hours 17. 8. $34\frac{2}{7}$.

CASE VIII.

(59) Firſt 6*s*. 8$\frac{1}{2}$*d*.=161 Half-pence and 1£.=480 ditto.
Then $\frac{161}{480}$, is the Fraction required.
(60) Firſt 4$\frac{1}{2}$*d*.=9 Halfpence; and 1*s*.=24. Anſ. $\frac{9}{24}$ or $\frac{3}{8}$.
(61) Firſt 2£. 17*s*. 7$\frac{1}{5}$*d*.=3456 Fifths. Anſ. $\frac{3456}{4320}$ or $\frac{4}{5}$.
And 3£. 12*s*.— =4320 ditto.
(62) Firſt 8*s*. 2*d*.= 98 Pence. Anſwer $\frac{98}{252}$ or $\frac{7}{18}$.
And 1£. 1*s*.=252 ditto.
(63) Firſt 6 oz. 17 dwts. 21 grs.=3309 grs.
And 1 lb. =5760 Anſ. $\frac{3309}{5760}$ or $\frac{1013}{1920}$.
(64) Firſt 3qrs. 3 lb. 1 oz. 12$\frac{5}{9}$=200705 Ninths.
And 1 Cwt. =258048 Anſwer $\frac{209705}{258048}$.
(65) Firſt 10 Cwt. 18 lb. 1$\frac{5}{31}$ oz.=564480 or $\frac{63}{124}$ Anſwer.
And 1 Ton =1111040
(66) Firſt 3 Qrs. $\frac{1}{8}$ =25 Eights. or $\frac{5}{8}$, the Anſwer.
And 1 Ell Eng. =40
(67) Firſt 2 Feet 6 Inch.=30 Inches. or $\frac{5}{6}$, the Anſwer.
And 1 Yard =36
(68) Firſt 4 Fur. 32 p.=192 Poles. or $\frac{3}{5}$, the Anſwer.
And 1 Mile =320
(69) Firſt 3 Roods 2 p.=122 Poles. or $\frac{61}{80}$, the Anſwer.
And 1 Acre =160
(70) Thus $\frac{42}{63}$ or $\frac{2}{3}$, the Fraction required.
(71) Thus $\frac{28}{36}$ or $\frac{7}{9}$, the Fraction required.
(72) Firſt 14 Buſh. 2 Pks.= 58 Pecks. or $\frac{29}{72}$, the Anſwer.
And a Chaldron =144
(73) Firſt 1 W. 3 d. 12 h.=252 Hours. or $\frac{3}{8}$, the Anſwer.
And 1 Month =672
(74) Firſt 243 D. 8 h.=5840 Hours. or $\frac{2}{3}$, the Anſwer.
And 1 Year =8760

39. ADDITION OF VULGAR FRACTIONS.

(1) Thus $\frac{3}{7}+\frac{1}{4}+\frac{5}{6}=\frac{72}{168}+\frac{42}{168}+\frac{140}{168}=\frac{254}{168}$ or 1$\frac{43}{84}$ Anſwer.
(2) Thus $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}=\frac{360}{720}+\frac{480}{720}+\frac{540}{720}+\frac{576}{720}+\frac{600}{720}$
$=\frac{2536}{720}$ or 3$\frac{11}{20}$, the Sum required.
Firſt $\frac{2}{3}$ of $\frac{4}{5}=\frac{8}{15}$.
(3) Then $\frac{8}{15}+\frac{13}{15}=\frac{21}{15}$ or 1$\frac{2}{5}$, the Sum required.

(4) Firſt $\frac{3}{7}$ of $\frac{5}{6}=\frac{5}{14}$, and $\frac{5}{9}$ of $\frac{3}{4}=\frac{5}{12}$.
Then $\frac{5}{14}+\frac{5}{12}=\frac{60}{168}+\frac{70}{168}=\frac{130}{168}$ or $\frac{65}{84}$, the Sum req.

(5) Firſt $\frac{1}{5}$ of $\frac{5}{6}=\frac{1}{6}$, (ſee Note Caſe II.
Then $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{6}=\frac{72}{144}+\frac{48}{144}+\frac{36}{144}+\frac{24}{144}=\frac{180}{144}$ or $1\frac{1}{4}$ the Sum required.

(6) Firſt $\frac{1}{2}+\frac{3}{4}=\frac{4}{8}+\frac{6}{8}$ or $\frac{2}{4}+\frac{3}{4}=\frac{5}{4}$ or $1\frac{1}{4}$. Then $4+17+$ $+1\frac{1}{4}=22\frac{1}{4}$, the Sum required.

(7) Firſt $\frac{2}{3}+\frac{4}{5}+\frac{7}{10}=\frac{100}{150}+\frac{120}{150}+\frac{105}{150}=\frac{325}{150}$ or $2\frac{1}{6}$. Then $7+9+6+2\frac{1}{6}=24\frac{1}{6}$, the Sum required.

(8) Firſt $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}=\frac{360}{720}+\frac{480}{720}+\frac{540}{720}+\frac{576}{720}+\frac{600}{720}=$ $\frac{2556}{720}$ or $3\frac{11}{20}$.
Then $8+9+10+11+12+3\frac{11}{20}=53\frac{11}{20}$, the Sum req.

(9) Firſt $\frac{1}{8}$ of 1*s.* $=\frac{1}{160}$ of 1£. per Caſe VI.
Then $\frac{201}{460}+\frac{1}{160}=\frac{32160}{73600}+\frac{460}{73600}=\frac{32620}{73600}$ or $\frac{1631}{3680}$£. which by Caſe VII. $=8s.\ 10\frac{1}{4}d.\ \frac{1}{23}$.

(10) Firſt $\frac{3}{8}$ of an oz. $=\frac{3}{96}$ or $\frac{1}{32}$ of a lb.
Then $\frac{1}{4}+\frac{1}{32}=\frac{32}{128}+\frac{4}{128}=\frac{36}{128}=\frac{9}{32}$ lb. or 3 oz. 7 dwts. 12 grs. the Sum required.

(11) Firſt $\frac{1}{3}$ of a lb. $=\frac{1}{336}$ of a Cwt.
Then $\frac{5}{8}+\frac{1}{336}=\frac{1680}{2688}+\frac{8}{2688}=\frac{1688}{2688}=\frac{211}{336}$ Cwt. or 2qrs. 14lb. 5 oz. $5\frac{1}{8}$ drs. the Anſwer.

(12) Firſt $\frac{2}{5}$ of an Ell Eng. $=\frac{2}{4}$ of a Yard.
Then $\frac{3}{4}+\frac{2}{4}=\frac{5}{4}$ yd. or 1 yd. 1 qr. the Sum required.

(13) Firſt $\frac{2}{3}$ of a Yard $=\frac{2}{5280}$ or $\frac{1}{2640}$ of a Mile.
Then $\frac{5}{6}+\frac{1}{2640}=\frac{13200}{15840}+\frac{6}{15840}=\frac{13206}{15840}=\frac{2201}{2640}$ Mile. or 6 Fur. 26 p. 4 yds. 1 ft. the Sum required.

(14) Firſt $\frac{1}{2}$ of a Peck $=\frac{1}{288}$ of a Chaldron.
Then $\frac{3}{8}+\frac{1}{288}=\frac{864}{2304}+\frac{8}{2304}=\frac{872}{2304}=\frac{109}{288}$ or 13 Buſh. 2 pks. 1 gall. the Sum required.

(15) Firſt $\frac{3}{4}$ of a Week $=\frac{3}{16}$ of a Month.
Then $\frac{3}{16}+\frac{5}{6}=\frac{18}{96}+\frac{80}{96}=\frac{98}{96}=\frac{49}{48}$ Mon. or 1 m. 14 hrs. the Sum required.

(16) Firſt $\frac{3}{4}$ of an Hour $=\frac{3}{672}$ or $\frac{1}{224}$ of a Week.
Then $\frac{1}{224}+\frac{5}{8}=\frac{8}{1792}+\frac{1120}{1792}=\frac{141}{224}$ or 4 D. 9 h. 45 m. the Sum required.

(17) Firſt $\frac{2}{5}$ of 12£. $=\frac{24}{5}$ or $4\frac{4}{5}$£. and $\frac{1}{5}$ of $\frac{9}{10}=\frac{9}{50}$.
Alſo $\frac{3}{5}$ of $\frac{5}{6}$ of $\frac{1}{20}=\frac{1}{40}$.
Then $\frac{4}{5}+\frac{5}{7}+\frac{9}{50}+\frac{1}{40}=\frac{56000}{70000}+\frac{30000}{70000}+\frac{12600}{70000}+$ $\frac{1750}{70000}=\frac{100350}{70000}$ or $1\frac{607}{1400}$.
Then $4+4+1\frac{607}{1400}=9\frac{607}{1400}$£. or 9£. 8*s.* 8*d.* $\frac{2}{35}$, the Sum required.

40. SUBTRACTION OF VULGAR FRACTIONS.

(1) Thus $\frac{11}{12}-\frac{2}{9}=\frac{99}{108}-\frac{24}{108}=\frac{75}{108}$, or $\frac{25}{36}$, the Diff. req.
(2) Thus $\frac{19}{64}-\frac{2}{13}=\frac{247}{832}-\frac{128}{832}=\frac{119}{832}$, the Diff. required.
(3) Thus $\frac{14}{17}-\frac{7}{11}=\frac{154}{187}-\frac{119}{187}=\frac{35}{187}$, the Diff. required.
(4) Firſt $\frac{3}{4}$ of $\frac{7}{8}=\frac{21}{32}$.
Then $\frac{21}{32}-\frac{2}{5}=\frac{105}{160}-\frac{64}{160}=\frac{41}{160}$, the Diff. required.
(5) Firſt $\frac{5}{6}$ of $\frac{7}{10}=\frac{7}{12}$, and $\frac{2}{3}$ of $\frac{1}{2}=\frac{1}{3}$.
Then $\frac{7}{12}-\frac{1}{3}=\frac{21}{36}-\frac{12}{36}=\frac{9}{36}$ or $\frac{1}{4}$, the Diff. required.
(6) Thus $10\frac{3}{4}-6\frac{5}{6}=10\frac{18}{24}-6\frac{20}{24}=3\frac{22}{24}$ or $3\frac{11}{12}$, the Diff.
(7) Thus $17\frac{11}{12}-16\frac{6}{7}=17\frac{77}{84}-16\frac{72}{84}=1\frac{5}{84}$, the Diff.
(8) Firſt $\frac{5}{6}$ of $\frac{7}{8}$ of $\frac{3}{4}=\frac{35}{64}$.
Then $12-\frac{35}{64}=11\frac{29}{64}$, the Difference.
(9) Firſt $\frac{3}{4}$ of a Penny $=\frac{3}{48}$ or $\frac{1}{16}$ of 1*s.* per Caſe VI.
Then $\frac{2}{3}-\frac{1}{16}=\frac{32}{48}-\frac{3}{48}=\frac{29}{48}$*s.* or $7\frac{1}{4}$*d.* per Caſe VII. Anſ.
(10) Firſt $\frac{3}{4}$ of an oz. $=\frac{3}{7168}$ of a Cwt.
Then $\frac{1}{3}-\frac{3}{7168}=\frac{7168}{21504}-\frac{9}{21504}=\frac{7159}{21504}$ C. or 1 qr. 9 lb. 4 oz. $9\frac{1}{8}$ drs. the Difference required.
(11) Firſt $\frac{3}{8}$ of an Inch $=\frac{3}{288}$ or $\frac{1}{96}$ of a Yard.
Then $\frac{3}{4}-\frac{1}{96}=\frac{288}{384}-\frac{4}{384}=\frac{284}{384}=\frac{71}{96}$ Yd. or 2 ſt. $2\frac{5}{8}$ in. the Difference required.
(12) Firſt $\frac{3}{4}$ of a Peck $=\frac{3}{576}$ or $\frac{1}{192}$ of a Chaldron.
Then $\frac{3}{8}-\frac{1}{192}=\frac{576}{1536}-\frac{8}{1536}=\frac{568}{1536}=\frac{71}{192}$ Chal. or 13 Buſh. 1 Pk. 1 Gall. the Difference.
(13) Firſt $\frac{3}{4}$ of an Hour $=\frac{3}{96}$ or $\frac{1}{32}$ of a Day.
Then $\frac{5}{6}-\frac{1}{32}=\frac{160}{192}-\frac{6}{192}=\frac{77}{96}$ Day; or 19 h. 15 min. the Difference.

41. MULTIPLICATION OF VULGAR FRACTIONS.

(1) Thus $\frac{6}{11}\times\frac{7}{12}=\frac{7}{22}$ (ſee Note in Page 136) the Product required.
(2) Thus $12\frac{1}{2}\times 6=75$, the Product required.
(3) Firſt $17\frac{3}{5}=\frac{88}{5}$.
Then $\frac{88}{5}\times\frac{7}{8}=\frac{77}{5}$ or $15\frac{2}{5}$, the Product required.
(4) Firſt $2\frac{3}{4}=\frac{11}{4}$, and $\frac{3}{4}$ of $\frac{7}{8}=\frac{21}{32}$.
Then $\frac{11}{4}\times\frac{21}{32}=\frac{231}{128}$ or $1\frac{103}{128}$, the Product required.
(5) Firſt $12\frac{3}{4}=\frac{51}{4}$, and $\frac{7}{8}$ of $\frac{12}{1}=\frac{21}{2}$.
Then $\frac{51}{4}\times\frac{21}{2}=\frac{1071}{8}$ or $133\frac{7}{8}$, the Product required.

(6) Firſt $\frac{3}{4}$ of $\frac{10}{11}=\frac{15}{22}$.
Then $\frac{15}{22}\times\frac{6}{1}=\frac{46}{11}$ or $4\frac{1}{11}$, the Product required.

(7) Firſt $\frac{7}{8}$ of $\frac{3}{4}=\frac{21}{32}$ and $\frac{2}{5}$ of $\frac{5}{7}$ of $\frac{14}{1}=\frac{4}{1}$.
Then $\frac{21}{32}\times\frac{4}{1}=\frac{21}{8}$, or $2\frac{5}{8}$, the Product.

(8) Firſt $3\frac{2}{3}=\frac{11}{3}$.
Then $\frac{11}{3}\times\frac{1}{7}=\frac{11}{21}$. Alſo $\frac{3}{5}$ of $\frac{3}{4}=\frac{9}{20}$.
Again $\frac{11}{21}\times\frac{9}{20}=\frac{33}{140}$, the Product required.

42. DIVISION of VULGAR FRACTIONS.

(1) Thus $\frac{6}{7}\div\frac{3}{5}$ or $\frac{6}{7}\times\frac{5}{3}=\frac{10}{7}$ or $1\frac{3}{7}$, the Quotient required.

(2) Firſt $\frac{2}{3}$ of $\frac{7}{8}=\frac{7}{12}$.
Then $\frac{2}{11}\div\frac{7}{12}$ or $\frac{2}{11}\times\frac{12}{7}=\frac{24}{77}$, the Quotient required.

(3) Firſt $12\frac{1}{2}=\frac{25}{2}$, and $17\frac{2}{3}=\frac{53}{3}$.
Then $\frac{25}{2}\div\frac{53}{3}$ or $\frac{25}{2}\times\frac{3}{53}=\frac{75}{106}$, the Quotient required.

(4) Firſt $12\frac{3}{4}=\frac{51}{4}$, and $3\frac{7}{8}=\frac{31}{8}$.
Then $\frac{51}{4}\div\frac{31}{8}$ or $\frac{51}{4}\times\frac{8}{31}=\frac{102}{31}$ or $3\frac{9}{31}$, the Quot. req.

(5) Firſt $\frac{7}{8}$ of $\frac{3}{4}=\frac{21}{32}$, and $\frac{2}{5}$ of $\frac{12}{1}=\frac{24}{5}$.
Then $\frac{21}{32}\div\frac{24}{5}$ or $\frac{21}{32}\times\frac{5}{24}=\frac{35}{256}$, the Quotient required.

(6) Firſt $7\frac{2}{7}=\frac{51}{7}$, then $\frac{51}{7}\div\frac{9}{1}$ or $\frac{51}{7}\times\frac{1}{9}=\frac{17}{21}$, the Quot.

(7) Thus $\frac{96}{1}\div\frac{146}{1}$ or $\frac{96}{1}\times\frac{1}{146}=\frac{48}{73}$, the Quot. required.

(8) Firſt $14\frac{3}{7}=\frac{101}{7}$, and $\frac{3}{4}$ of $\frac{12}{1}=\frac{9}{1}$.
Then $\frac{101}{7}\div\frac{9}{1}$ or $\frac{101}{7}\times\frac{1}{9}=\frac{101}{63}$ or $1\frac{88}{63}$, the Quot. req.

(9) Firſt $142\frac{7}{12}=\frac{1711}{12}$, and $12\frac{3}{5}=\frac{63}{5}$.
Then $\frac{1711}{12}\div\frac{63}{5}$ or $\frac{1711}{12}\times\frac{5}{63}=\frac{8555}{756}$ or $11\ \frac{239}{756}$, the Quotient required.

(10) Firſt $\frac{7}{8}$ of $\frac{6}{1}=\frac{21}{4}$, and $\frac{3}{4}$ of $\frac{6}{7}$ of $\frac{11}{17}=\frac{33}{56}$.
Then $\frac{21}{4}\div\frac{33}{56}$ or $\frac{21}{4}\times\frac{56}{33}=\frac{1176}{132}$ or $8\frac{10}{11}$, the Quot. req.

1. If the Diviſor and Dividend have both the ſame Denominator, the Quotient may be found by dividing one Numerator by the other.

Thus $\frac{7}{11}\div\frac{4}{11}$; thus $7\div4=\frac{4}{7}$. the Quotient required.

2. If the Diviſor and Dividend have each the ſame Numerator, divide one of the Denominators by the other, which will give the Quotient required.

Divide $\frac{8}{17}$ by $\frac{8}{11}$; thus $17\div11=\frac{11}{17}$ the Quotient.

3d. If a Number can be found that will divide both the Numerators, or both the Denominators, (viz. thoſe of the Diviſor and Dividend) without a Remainder; uſe thoſe Quotients inſtead of the given Numerators and Denominators, which will give the Reſult in its loweſt Terms.

Divide $\frac{8}{15}$ by $\frac{9}{16}$; thus $\frac{8}{15} \div \frac{9}{16} = \frac{1}{5} \div \frac{3}{2} = \frac{3}{10}$, the Quotient required.

For 8 and 16 divide by 8, alſo 15 and 9 divide by 3.

43. THE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

(1) If $2\frac{2}{5}$ yds. : $3\frac{3}{4}$£. $4\frac{4}{5}$ yds. Or

As $\frac{12}{5} : \frac{15}{4} :: \frac{24}{5} : \frac{15}{2}$£.

For $\left\{\begin{matrix}24\times15\times5\\12\times\ 4\times5\end{matrix}\right\} = \frac{15}{2}$£. or 7£. 10s. the Anſwer.

(2) Firſt 5*s*. 6d.$=\frac{11}{40}$£. Then,

As $\frac{3}{4} : \frac{11}{40} :: \frac{339}{8} : \frac{1243}{80}$£.

For $\left\{\begin{matrix}339\times11\times4\\3\times40\times8\end{matrix}\right\} = \frac{1243}{80}$£. or 15£. 10*s*. 9*d*. the Anſwer.

(3) Firſt 14*s*. 8*d*. or $14\frac{2}{3} = \frac{11}{15}$£. Then

As $\frac{7}{9} : \frac{11}{15} :: \frac{8}{1} : \frac{264}{35}$.

For $\left\{\begin{matrix}9\times11\times8\\7\times15\times1\end{matrix}\right\} = \frac{264}{35}$£. or 7£. 10*s*. $10\frac{1}{4}$*d*. $\frac{1}{7}$ the Anſwer.

(4) Firſt $10\frac{1}{2} = \frac{21}{2}$£. and $2700\frac{1}{2} = \frac{5401}{2}$.

As $\frac{100}{1} : \frac{21}{2} :: \frac{5401}{2} : \frac{113411}{400}$£.

For $\left\{\begin{matrix}5401\ \ \times21\\100\times2\times2\end{matrix}\right\} = \frac{113421}{400}$£. or 283£. 11*s*. $0\frac{1}{2}d\frac{2}{5}$. the Anſwer.

(5) Firſt $112\frac{5}{8} = \frac{901}{8}$£. Then

As $\frac{901}{8} : \frac{100}{1} :: \frac{1270}{1} : \frac{1016000}{901}$.

For $\left\{\begin{matrix}1270\times8\times100\\901\times1\times\ \ 1\end{matrix}\right\} = \frac{1016000}{901}$ or 1127£ 12*s*. $1\frac{1}{2}$*d*. $\frac{470}{901}$, the Anſwer.

(6) Firſt $4\frac{3}{4} = \frac{19}{4}$ Pieces. And $22\frac{3}{8} = \frac{179}{8}$ Yards in each Piece. Then $\frac{179}{8} \times \frac{19}{4} = \frac{2401}{32}$ Yards bought. Alſo 8*s*. 9*d*.$=\frac{7}{16}$£. Therefore,

As $\frac{1}{1} : \frac{7}{16} :: \frac{3401}{32} : \frac{23807}{512}$

For $\left\{\begin{matrix}3401\times\ 7\\32\times16\end{matrix}\right\} = \frac{23807}{512}$£. or 46£. 9*s*. $11\frac{1}{2}$*d*. $\frac{1}{8}$ the Anſwer.

(7) Firſt 100£. 10s. 6d.$=\frac{4021}{40}$£. and 5s. 6$\frac{1}{4}$d.$=\frac{89}{320}$£.
Alſo 1 Ell Fl.$=\frac{3}{5}$ Ell Eng. Therefore
As $\frac{89}{320} : \frac{3}{5} : : \frac{4021}{40} : \frac{96504}{445}$
For $\left\{\begin{matrix} 4021\times320\times3 \\ 89\times5\times40 \end{matrix}\right\}=\frac{96504}{445}$ Ells Eng.
Now $\frac{96504}{445}\div\frac{12}{1}=\frac{8042}{445}$ or 18$\frac{32}{445}$ Ells Eng. in each Piece.

44. THE RULE OF THREE INVERSE.

(1) Firſt 25$\frac{1}{3}=\frac{76}{3}$£. and 6$\frac{3}{4}=\frac{27}{4}$ Months.
Alſo 10$\frac{3}{4}=\frac{43}{4}$£. Then
As $\frac{76}{3} : \frac{27}{4} : : \frac{43}{4} : \frac{684}{43}$M.
For $\left\{\begin{matrix} 76\times27\times\cancel{4} \\ 43\times\cancel{4}\times\cancel{3} \end{matrix}\right\}=\frac{684}{43}$M. or 15 M. 27$\frac{9}{43}$ days, the Anſwer.

(2) Firſt 12$\frac{3}{4}=\frac{51}{4}$ Hours. Then
As $\frac{4}{1} : \frac{51}{4} : : \frac{12}{1} : \frac{51}{12}$ Hours.
For $\left\{\begin{matrix} 51\times\cancel{4} \\ 12\times\cancel{4} \end{matrix}\right\}=\frac{17}{4}$ Hours, or 4$\frac{1}{4}$ Hours, the Anſ.

(3) Firſt 12$\frac{2}{3}=\frac{38}{3}$ Oz. and 8$\frac{3}{4}=\frac{35}{4}$ ditto. Then
As $\frac{38}{3} : \frac{5}{1} : : \frac{35}{4} : \frac{152}{21}$s.
For $\left\{\begin{matrix} 38\times5\times4 \\ 35\times3\times1 \end{matrix}\right\}=\frac{152}{21}$ or 7s. 2$\frac{1}{4}$d. $\frac{3}{7}$ the Anſwer.

(4) Firſt 100$\frac{2}{3}=\frac{302}{3}$£. and 6$\frac{2}{3}=\frac{20}{3}$ M. or $\frac{20}{3}$ of $\frac{1}{12}=\frac{5}{9}$ Yr. Alſo 3$\frac{5}{6}=\frac{23}{6}$ Yrs. Then
As $\frac{5}{9} : \frac{302}{3} : : \frac{23}{6} : \frac{3020}{207}$
For $\left\{\begin{matrix} 302\times5\times6 \\ 23\times3\times9 \end{matrix}\right\}=\frac{3020}{207}$£. or 14£. 11s. 9$\frac{1}{4}\frac{55}{69}$d. the Anſwer.

(5) Firſt 8$\frac{1}{2}=\frac{17}{2}$s. and 26$\frac{5}{8}=\frac{213}{8}$ Yards. Alſo 5s. 7d.$=\frac{67}{12}$s.
Then
As $\frac{67}{12} : \frac{213}{8} : : \frac{17}{2} : \frac{14271}{816}$.
For $\left\{\begin{matrix} 213\times67\times2 \\ 12\times17\times8 \end{matrix}\right\}=\frac{4757}{872}$ Yds. or 17$\frac{133}{272}$ Yards, the Anſwer.

48. The

45. THE DOUBLE RULE OF THREE.

(1) Firſt 4£. 15s. $=4\frac{3}{4}$£. or $\frac{19}{4}$£. and 9 M. $=\frac{3}{4}$ Yr. Then
100£. 1 Yr. : 6£. | Now $\frac{3}{4}\times\frac{6}{1}=\frac{9}{2}$ Diviſor.
— : $\frac{3}{4}$: $\frac{19}{4}$ | And $\frac{100}{1}\times\frac{19}{4}=\frac{475}{1}$ Dividend.
Then $\frac{475}{1}\div\frac{9}{2}=\frac{950}{9}$£. or 105£. 11s. $1\frac{1}{4}$*d.* $\frac{1}{3}$, the Anſwer.
Or by two Statings thus
1ſt. As 1 : 100 : : $\frac{3}{4}$: $\frac{400}{3}$.
2d. As $\frac{6}{1}$: $\frac{400}{3}$: : $\frac{19}{4}$: $\frac{950}{9}$ or 105£. 11*s.* $1\frac{1}{4}$*d.* $\frac{1}{3}$.

(2) Firſt 14£. 6*s.* 8*d.* $=14\frac{1}{3}$ or $\frac{43}{3}$£. Then
12 Stu. : 16 D : $\frac{43}{3}$£. | Now $12\times16=192$ Diviſor.
18 : 34 : — | And $\frac{43}{3}\times\frac{34}{1}\times\frac{18}{1}=\frac{8772}{1}$ Divid.
Then $8772\div192=$ 45£. 13*s.* 9*d.* the Anſwer.
Or thus, 1ſt. As $\frac{12}{1}$: $\frac{43}{3}$: : $\frac{18}{1}$: $\frac{43}{2}$£.
2d. As $\frac{16}{1}$: $\frac{43}{2}$: : $\frac{34}{1}$: $\frac{731}{16}$ or 45£. 13*s.* 9*d.*

(3) Firſt 16£. 13*s.* 4*d.* $=16\frac{2}{3}$ or $\frac{50}{3}$£. And 6£. 17*s.* 6*d.* $=6\frac{7}{8}$ or $\frac{55}{8}$£. Then
40 Cwt. : 30 M. $\frac{50}{3}$£. | Now $\frac{50}{3}\times\frac{80}{1}=\frac{4000}{3}$ Diviſor.
— : 80 : $\frac{55}{8}$ | And $\frac{40}{1}\times\frac{30}{1}\times\frac{55}{8}=\frac{8250}{1}$ Div.
Then $\frac{8250}{1}\div\frac{4000}{3}=\frac{99}{16}$ Cwt. or 6 Cwt. 21 lbs. the Anſw.
Or thus, 1ſt. As 30 : 40 : : 80 : 15 Cwt.
2d. As $\frac{50}{3}$: $\frac{15}{1}$: : $\frac{55}{8}$: $\frac{99}{16}$ or 6 Cwt. 21lbs.

(4) Firſt 26£. 19*s.* 4*d.* $=26\frac{29}{36}$ or $\frac{809}{30}$£. And 14£. 15*s.* $=14\frac{3}{4}$ or $\frac{59}{4}$£.
12 Per. 3 M. : $\frac{809}{30}$£. | Now $\frac{809}{30}\times\frac{36}{1}=\frac{4854}{5}$ Diviſor.
36 : — : $\frac{59}{4}$ | And $\frac{59}{4}\times\frac{12}{1}\times\frac{3}{1}=\frac{531}{1}$ Divid.
Then $\frac{531}{1}\div\frac{4854}{5}=\frac{2655}{4854}$ M. or $16\frac{331}{809}$ Days, the Anſwer.
Or thus, 1ſt. As 12 : 3 : : 36 : 1 Month.
2d. As $\frac{809}{30}$: $\frac{1}{1}$: : $\frac{59}{4}$: $\frac{885}{1618}$ Mo. or $16\frac{331}{809}$ Days.

(5) 30 M : 11 D. 1 W. | Now $\frac{11}{5}\times\frac{1}{1}=\frac{11}{5}$ Diviſor.
— : $\frac{11}{5}$: 4 | And $30\times11\times4=1320$ Divid.
Then $\frac{1320}{1}\div\frac{11}{5}=\frac{6600}{11}$ or 600 Men the Anſwer.
Or thus, 1ſt. As 1 : 30 : : 4 : 120 Men.
2d. As 11 : 120 : : $\frac{11}{5}$: $\frac{6600}{11}$ or 600 Men.

(6) Firſt $2\frac{1}{2}=\frac{5}{2}$ Tons. And $3-\frac{1}{10}=2\frac{9}{10}$ or $\frac{29}{10}$ Miles. Alſo $\frac{1}{8}$ of $\frac{3}{5}$ of $\frac{21}{1}=\frac{63}{40}s.$ Likewiſe 1 Cwt. $=\frac{1}{20}$ Ton. Then

$\frac{5}{2}$T. : $\frac{29}{10}$M. : $\frac{63}{40}s.$ | Now $\frac{29}{10}\times\frac{5}{2}=\frac{29}{4}$ Diviſor.
$\frac{1}{20}$: 1 : —— | And $\frac{63}{40}\times\frac{1}{20}=\frac{63}{800}$ Dividend.

Then $\frac{63}{800}\div\frac{29}{4}=\frac{252}{23200}s.$ or $\frac{378}{725}$ Qr. the Anſwer.
Or thus, 1ſt. As $\frac{5}{2}:\frac{63}{40}::\frac{1}{20}:\frac{63}{2000}$.
2d. As $\frac{29}{10}:\frac{63}{2000}::\frac{1}{1}:\frac{252}{23200}s.$ or $\frac{378}{725}$ Qr.

46. QUESTIONS IN VULGAR FRACTIONS.

(1) Thus $99\frac{9}{9}$ the Anſwer. For $\frac{9}{9}=1$, and $99+1=100$.

(2) Firſt $\frac{3}{10}$ of $\frac{18}{7}$ of $\frac{141}{213}=\frac{1269}{2485}$.
∵ $\frac{1}{1}-\frac{1269}{2485}=\frac{1216}{2485}$ Anſw. For $\frac{1269}{2485}+\frac{1216}{2485}=1$, Proof.

(3) Firſt $\frac{1}{25}$ of $\frac{7}{8}=\frac{7}{200}$, and $\frac{1}{16}$ of $\frac{47}{19}=\frac{47}{304}$.
∵ $3\frac{7}{200}-\frac{47}{304}=3\frac{2128}{60800}-\frac{9400}{60800}=2\frac{53528}{60800}$ or $2\frac{6691}{7600}$ the Anſwer.
For $2\frac{53528}{60800}-\frac{2128}{60800}=2\frac{51400}{60800}$ which added to $\frac{9400}{60800}=3$, the Proof.

(4) Firſt $\frac{1}{11}$ of $\frac{12}{1}=\frac{12}{11}$, and $\frac{1}{19}$ of $\frac{27}{1}=\frac{27}{19}$.
Then $\frac{12}{11}+\frac{27}{19}=\frac{228}{209}+\frac{297}{209}=\frac{525}{209}=2\frac{107}{209}$.
Again $7\frac{1}{2}=\frac{15}{2}$, then $\frac{1}{3}$ of $\frac{15}{2}=\frac{5}{2}$; alſo $1\frac{1}{4}=\frac{5}{4}$, and $\frac{29}{30}$ of $\frac{5}{4}=\frac{29}{24}$; then $\frac{5}{2}-\frac{29}{24}=\frac{31}{24}$ or $1\frac{7}{24}$, which added to $8=9\frac{7}{24}$.
∵ $9\frac{7}{24}-2\frac{107}{209}=9\frac{1463}{5016}-2\frac{2568}{5016}=6\frac{911}{5016}$, the Anſwer.

(5) Firſt $\frac{3}{4}$ of $\frac{7}{8}$ of $\frac{11}{4}=\frac{231}{128}$.
∵ $\frac{1}{1}\div\frac{231}{128}=\frac{128}{231}$ the Number, therefore $\frac{128}{231}\times\frac{128}{231}\times\frac{128}{231}=\frac{2097152}{12326391}$, the Cube of that Number.

(6) Firſt $\frac{2}{3}$ of $\frac{3}{16}=\frac{1}{8}$, and $9\frac{28}{37}=\frac{361}{37}$.
∵ $\frac{361}{37}\times\frac{1}{8}=\frac{361}{296}$, the Number.
And $\frac{361}{296}\times\frac{361}{296}=\frac{130321}{87616}$ or $1\frac{42705}{87616}$ Sqr.

(7) Firſt $\frac{3}{7}$ of $\frac{4}{5}$ of $\frac{7}{8}=\frac{3}{10}$; alſo $\frac{1}{9}$ of $\frac{6}{7}$ of $\frac{11}{13}=\frac{22}{273}$.
Then, as $\frac{3}{10}:\frac{22}{273}::\frac{12000}{1}:\frac{880000}{273}=3223$£. 8*s.* $10\frac{1}{4}d.$ $\frac{45}{91}$, the Value of the Ship.
∵ $12000+3223$£. 8*s.* $10\frac{1}{4}d.$ $\frac{45}{91}=15223$£. 8*s.* $10\frac{1}{4}d.$ $\frac{45}{91}$, the Anſwer.

(8) Firſt $\frac{3}{4}$ of $\frac{3}{5}=\frac{9}{20}$ fold. Then, as $\frac{9}{20}:\frac{1710}{1}::\frac{20}{20}$ or $\frac{1}{1}:\frac{11400}{3}=3800$£. the Anſwer.

(9) His whole Eſtate $\frac{83}{83}-\frac{34}{83}=\frac{49}{83}$. Then $\frac{34}{83}$ of $\frac{49}{83}=\frac{1666}{6889}$ youngeſt Son's Part; and $\frac{34}{83}=\frac{2882}{6889}$ eldeſt.
$\therefore \frac{2822}{6889}-\frac{1666}{6889}=\frac{1156}{6889}=57$£. 3^s. 4^d. or $\frac{1543}{6}$.
Alſo $\frac{2822}{6889}+\frac{1666}{6889}=\frac{4488}{6889}$ both the Sons part.
So that $\frac{6889}{6885}-\frac{4488}{6889}=\frac{2401}{6889}$, Widow's Part.

Then by rejecting the Common Denominator we ſhall have the following Proportion £. *s.* *d.*
As $1156 : \frac{1543}{6} :: 2401 : \frac{3704743}{6936} =$ 534 2 $7\frac{1}{4}$ $\frac{684}{3468}$ Widow had the Uſe of.
As $1156 : \frac{1543}{6} :: 2822 : \frac{2177173}{3468} =$ 627 15 $9\frac{1}{4}$ $\frac{2244}{3468}$ eldeſt Son had.
As $1156 : \frac{1543}{6} :: 1666 : \frac{1235319}{3468} =$ 370 12 $5\frac{1}{4}$ $\frac{2244}{3468}$

His whole Eſtate 1622 10 $10\frac{1}{4}$ $\frac{3224}{3468}$

(10) Firſt $\frac{19}{30}-\frac{11}{39}=\frac{741}{1170}-\frac{339}{1170}=\frac{411}{1170}$.
Then, as $\frac{411}{1170} : \frac{1081}{2}$£. :: $\frac{1170}{1170}$ or : $\frac{1}{1} : \frac{632385}{411}=1538$£. 12*s.* $11\frac{3}{4}$*d.* $\frac{267}{411}$, the Anſwer.

(11) Firſt 4000 his whole Stock.
Then $\frac{5}{8}$ of $\frac{2}{3}$ of $4000 = 1666\frac{2}{3}$ Mad Tom took.

$2333\frac{1}{3}=\frac{7000}{3}$ left.
$\frac{2}{5}$ of $\frac{5}{8}$ of $\frac{7000}{3} = 583\frac{1}{3}$ = Raving Ned took.

1750 left.
$\frac{7}{10}$ of $\frac{17}{20}$ of $1750 = 1041\frac{1}{4}$ Poſitive Jack took.

$708\frac{3}{4}=708\frac{48}{64}$ left.
$\frac{3}{4}$ of $\frac{1}{4}$ of $\frac{28354}{4} = 132\frac{57}{64}$ Dolly had.

Anſwer $575\frac{55}{64}$ left.

(12) As $\frac{5}{12} : 2200 :: \frac{12}{12}$ or : $\frac{1}{1}=5280$£. Brother's Fortune.
And $5280\times 3\frac{1}{8}=16500$; alſo $1\frac{1}{2}=\frac{3}{2}$.
$\therefore 16500 \div \frac{3}{2}=\frac{33000}{3}=11000$£. Father's Part.

(13)

	£.	*s.*
Firſt 175 Hhds. at 34£. each=34×17=	578	0
As $\frac{4}{7} : \frac{578}{1} :: \frac{7}{7} : \frac{4046}{4} =$	1011	10
13 Guns at 18£. 10*s.* each=18£. 10*s.*×13=	240	10
Value of what was caſt overboard	1830	0

Then $\frac{3}{7}$ of $\frac{9}{13}=\frac{27}{91}=1830$£. and $\frac{27}{91}+\frac{64}{91}=\frac{91}{91}$.
∵ As $\frac{27}{91}:\frac{1830}{1}::\frac{64}{91}:\frac{117120}{27}=4337$£. 15*s.* 6$\frac{2}{3}$*d.* the Value which came into Port.

(14) Firſt $16131\frac{7}{60}=\frac{161317}{10}$.
Then $\frac{7}{8}$ of $\frac{3}{5}$ of $\frac{1}{2}$ of $\frac{161317}{10}=\frac{3387657}{800}=4234$£. 11*s.* 5$\frac{1}{10}$*d.* A had at firſt.
And, $\frac{3}{5}$ of $\frac{4}{5}$ of $\frac{3387657}{800}=\frac{10162971}{5000}=2032$£. 11*s.* 10$\frac{1}{2}$*d.* $\frac{54}{325}$ ſold B.
∵ $\frac{161317}{10}-\frac{3387657}{800}=\frac{129053600}{8000}-\frac{3387657}{800}|\frac{0}{0}=\frac{9817603}{800}$
Alſo $\frac{8}{11}$ of $\frac{9517703}{800}=\frac{85659327}{8800}=9743$£. 3$\frac{1}{4}$*d.* $\frac{19}{55}$ Couſin P paid.

(15) Firſt $\frac{1}{34}=\frac{12}{408}$ X, $\frac{1}{24}=\frac{17}{408}$ Z.
Then $\frac{12}{408}+\frac{17}{408}=\frac{29}{408}$ performed in one Day by X and Z.
And $\frac{1}{12}=\frac{34}{408}$ performed in one Day by all three working together.
∵ $\frac{34}{408}-\frac{29}{408}=\frac{5}{408}$ done in one Day by Y.
Therefore, as, $\frac{5}{408}$: 1 Day :: 1 Work : $\frac{408}{5}=81\frac{3}{5}$ Days the Anſwer.

(16) Firſt $\frac{16}{16}-\frac{3}{16}=\frac{13}{16}$ left at 6 Months End.
Then $\frac{2}{3}$ of $\frac{13}{16}=\frac{13}{24}$; and $\frac{13}{16}-\frac{13}{24}=\frac{312}{384}-\frac{208}{384}=\frac{104}{324}$, or $\frac{13}{48}=348$ left.
∵ As $\frac{13}{48}:\frac{348}{1}::\frac{48}{48}$ or $\frac{1}{1}$: 1284,18, 5$\frac{1}{2}$ $\frac{2}{13}$ the Anſwer.

(17) As $\frac{3}{5}:\frac{19312}{1}::\frac{5}{5}:\frac{96560}{3}=32186$£. 13*s.* 4*d.* two Years Rent; which ÷ by 2 = 16093£. 6*s.* 8*d.* the yearly Income required.

(18) Firſt 880 Guineas = 924£.
Then as $\frac{3}{20}:\frac{924}{1}::\frac{20}{20}:\frac{18480}{3}=6160$£. the Anſwer.
∵ $2200+6160=8360=\frac{4}{5}$ of his whole Fortune.
Now as $\frac{4}{5}:\frac{8360}{1}::\frac{5}{5}:\frac{41800}{4}=10450$£.

(19) Here as the Son was to have twice as much as the Mother, and the Mother twice as much as the Daughter, ſo we will ſuppoſe the Eſtate to be divided as follows, viz. $4+2+1=7$ the whole Eſtate; then as ſhe had both a Son and a Daughter, the Mother muſt have but $\frac{2}{7}$ of the Eſtate; whereas had it been only a Daughter, ſhe would have had $\frac{2}{3}$.
Then $\frac{2}{3}-\frac{2}{7}=\frac{14}{21}-\frac{6}{21}=\frac{8}{21}=2000$£.
∵ As $\frac{8}{21}:\frac{2000}{1}::\frac{8}{3}:\frac{42000}{24}=1750$£. the Anſwer.

(20) Firſt Cock runs off 3 Galls. $=\frac{3}{103}$ of the Ciſtern in a Minute; and $1\frac{1}{4}$ Min. $=\frac{5}{4}$.

Then, as $\frac{5}{4} : \frac{3}{103} :: 1 : \frac{12}{515}$ runs off by both in a Minute.

And $\frac{3}{103}+\frac{12}{515}=\frac{15}{515}+\frac{12}{515}=\frac{27}{515}$ runs off by both in a Minute.

$\because$ As $\frac{27}{515} : 1 :: 1 : \frac{515}{27}=19$ Min. $4\frac{4}{9}$ ſec. the Anſwer.

(21) Firſt $\frac{1}{4}+\frac{1}{3}+\frac{1}{6}=\frac{18}{72}+\frac{24}{72}+\frac{12}{72}=\frac{54}{72}=\frac{3}{4}$.

Then as $\frac{3}{4} : \frac{45}{1} :: \frac{1}{1} : \frac{180}{3}=60$ Crowns the Anſwer.

(22) Firſt $\frac{1}{2}+\frac{1}{4}+\frac{1}{6}=\frac{24}{48}+\frac{12}{48}+\frac{8}{48}=\frac{44}{48}$ or $\frac{11}{12}$ and $\frac{12}{12}-\frac{11}{12}$ $=\frac{1}{12}=50$ Cherries.

$\frac{1}{2} = 50\times6=300$ Apples.
$\frac{1}{4} = 50\times3=150$ Pears.
$\frac{1}{6} = 50\times2=100$ Plums.
50 Cherries.

Anſwer in all 600 Trees.

(23) Firſt $1=\frac{4}{4}$, and $\frac{1}{2}=\frac{2}{4}$.

Then $\frac{4}{4}+\frac{4}{4}+\frac{2}{4}+\frac{1}{4}=\frac{11}{4}=99$ by the Queſtion.

$\because$ As $\frac{11}{4} : 99 :: 1 : \frac{396}{11}=36$ Scholars.

(24) Firſt $\frac{1}{2}+\frac{1}{3}+\frac{1}{5}=\frac{15}{30}+\frac{10}{30}+\frac{6}{30}=\frac{31}{30}$.

Then $\frac{31}{30}+\frac{30}{30}=\frac{61}{30}$; and $74-\frac{4}{5}=73\frac{1}{5}=\frac{366}{5}=\frac{2196}{30}$.

$\because \frac{61}{30} : \frac{2196}{30} :: 1 : \frac{2196}{61}=36$ Years, the Anſwer.

(25) $\left.\begin{array}{l} \text{Firſt } \frac{3}{8} \text{ of } \frac{2}{3}=\frac{1}{4} \text{ B's} \\ \text{And } \frac{3}{16} \text{ of } \frac{2}{3}=\frac{1}{5} \text{ C's} \end{array}\right\}$ Firſt Acquiſition, their Sum $=\frac{9}{20}$.

Then $\frac{2}{3}-\frac{9}{20}=\frac{13}{60}=\frac{91}{420}$ left.

$\because \frac{1}{7}$ of $\frac{13}{60}=\frac{13}{420}=$ E's firſt Acquiſition.

Alſo $\frac{91}{420}-\frac{13}{420}=\frac{78}{420}$ D's, thus ended the firſt Heat.

$$\left.\begin{array}{lrl} \text{Again } \frac{1}{2} \text{ of } \frac{1}{4}= & \frac{1}{8} & \text{B's} \\ \text{Retained} & \frac{1}{5} & \text{C's} \\ \text{And } \frac{13}{70}+\frac{1}{16}= & \frac{139}{560} & \text{D's} \\ \text{Alſo } \frac{13}{420}+\frac{1}{16}= & \frac{157}{1680} & \text{E's} \end{array}\right\} \text{Part at the End of the ſecond Scuffle.}$$

Proceeding $\frac{1}{4}$ of $\frac{1}{5}=\frac{1}{20}$ A's.

$\frac{1}{3}$ of $\frac{1}{5}+\frac{1}{8} = \frac{23}{120}$ B's.

$\frac{2}{7}$ of $\frac{1}{5}+\frac{130}{590}=\frac{171}{500}$ D's.

Then $\frac{1}{20}+\frac{1}{15}+\frac{2}{35}=\frac{7}{420}$.

$$\left.\begin{array}{l} \frac{1}{5}-\frac{73}{420}=\frac{11}{420}, \text{ and } \frac{1}{2} \text{ of } \frac{11}{420}= \frac{11}{840} \text{ C's} \\ \frac{157}{868}=\frac{11}{820} \qquad =\frac{179}{1680} \text{ E's} \end{array}\right\} \text{Part of the third Smuſs.}$$

Further $\frac{1}{20}+\frac{1}{15}=\frac{7}{60}$, and $\frac{3}{4}$ of $\frac{7}{60}=\frac{7}{80}$, loſt by A. and B.
Then $\frac{5}{16}$ of $\frac{7}{80}+\frac{1}{4}$ of $\frac{1}{20}=\frac{51}{1280}$ A.'s
Alſo $\frac{5}{16}$ of $\frac{7}{80}+\frac{1}{4}$ of $\frac{1}{25}$ of $\frac{1}{8}=\frac{649}{3840}$ B.'s } Part after the
$\frac{1}{8}$ of $\frac{7}{80}+\frac{11}{840}$ $=\frac{323}{13440}$ E.'s } laſt Smuſs.
$\frac{1}{8}$ of $\frac{7}{80}+\frac{171}{840}=\frac{1417}{4480}$ D.'s } Part after the Smuſs.
$\frac{1}{8}$ of $\frac{7}{80}+\frac{179}{1680}=\frac{1579}{13440}$ E.'s }
Then $\frac{51}{1280}+\frac{1}{15}=\frac{2863}{26880}$ A.'s }
And $\frac{649}{3840}+\frac{1}{15}=\frac{6335}{26880}$ B.'s }
Alſo $\frac{328}{13440}+\frac{1}{15}=\frac{2438}{26880}$ C.'s } Share carried off at the laſt.
$\frac{1417}{4480}+\frac{1}{15}=\frac{10294}{26880}$ D.'s }
$\frac{1579}{13440}+\frac{1}{15}=\frac{4950}{26880}$ E.'s }

So that if the Number of Sugar Plumbs were 26880.

A got 2863 }
B 6335 }
C 2438 } =26880, the Sum.
D 10294 }
E 4950 }

47. ADDITION OF DECIMALS.

	(1)	(2)	(3)
	,0476	,427	,274
	21,476	64,075	,076
	,0067	27,6421	,64762
	,64	10,8	,0706
	17,6	,0074	,47
	,20764	104,046842	,007
			968,42
Sum	39,97794	206,998342	969,96522

(4)	(5)	(6)
$47,67\dot{4}444$	11,4444444	14,2764210
$4,0\dot{2}6420$	6,1427400	$7,\dot{4}444444$
$32,\dot{6}66666$	$91,7\dot{8}88888$	$21,64\dot{6}6666$
6,144444	$37,67\dot{1}1111$	$9,2\dot{7}77777$
$27,\dot{0}64666$	146,4767410	$31,147\dot{4}444$
$117,57664\dot{2}$	$293,52392 5\dot{4}$	$88,79275\dot{4}3$

(7)
$14,\dot{2}47\dot{1}247\dot{1}$
$768,\dot{2}4\dot{6}24624$
$7,06\dot{4}06406$
$26,006\dot{2}0620$

815,56364122

(8)
$,\dot{2}4\dot{6}2462$
$3,\dot{6}7\dot{6}7672$
$27,04\dot{2}7694$
$9,\dot{9}469469$

40,9127298

48. SUBTRACTION OF DECIMALS.

(1) From 176,
Take 10,764

Diff. 165,236

(2) 647,
,00746

646,99254

(3) 74,6407
69,5

5,1407

(4) From $41,7\dot{4}4444$
Take 21,946480

Diff. 19,797964

(5) 24,1466
$19,\dot{9}999$

$4,146\dot{6}$

(6) $16,1\dot{2}6262\dot{6}26$
$4,194276\dot{4}$

$11,9389862\dot{2}\dot{6}$

49. MULTIPLICATION OF DECIMALS.

(1) ,17504
×76

Prod. 13,30304

(2) 27,42
×3,56

97,6152

(3) 8,04704
×,2575

2,0721128

(4) 5745
×,0675

Prod. 387,7875

(5) ,4
×,2

,08

(6) ,047
×,046

,002162

(7) ,000476
×,00078

,00000037128

(8) ,47 × by ,0008=,000376, the Product.

(9) 1,076×1000=1076. (10) ,42768×10000=4276,8.

(11) 3,47678
×2876,72 Mul. inverted.
69536
24337
2086
243
28
1
96,231

(12) 47,689464
×49671,62
95378928
28613678
476895
333826
28613
4292
191
1248,36423

(13) 147,6$\cancel{4}$
×,7
Prod. 103,351

(14) 42,64$\cancel{2}$
×,276
25585$\cancel{3}$
2984955
8528$\cancel{4}$44
11,769253

(15) 46,2762
$\cancel{8}$
9)370,2096
Prod. 41,13$\cancel{4}$

(16) 261,276
,4$\cancel{7}$
9)18,28932
2,03214$\cancel{6}$
104,5104
Prod. 124,83186

(17) 141,1$\cancel{4}$
8,4$\cancel{7}$
9)98801
109777
564577
11291555
1196,5911

(18) 24,607$\cancel{2}$
,496
9)1476432
1640480
22146500
98428888
12,215868

(19)
7,642
6
45,855

(20)
64,842
27,9
583585
4538999
12968555
1809,1141

(21)
46,74
4,267
32718
28044
9348
18696
19943958
19943
19
199,63922

(22)
764,742
,6074
3058968
5353194
4588452
4645042908
464504
46
464,5507460

(23)
47,642
3,674
190570
3334988
28585555
142927777
175,038892
175038
175
175,214106

(24)
76,28
8,495
38141
606544
3051333
61025555
648,015,74
64801
64
648,66,440

50. DIVISION OF DECIMALS.

Diviſ. Divid. Quot. *Diviſ. Divid. Quot.*

(1) 6,5)1735,5(267 (2) ,0084),8332(99,19047

(3) 7,476)186,900(25 (4) ,008)6,000(750

(5) 604,25)246,1476(,40736+ (6) 119)7,268401(,061079

(7) 647)6,7258(,010395+ (8) 678),0008136),0000012

(9) 1000)487,67(,48767 (10) 1,0000)4746(,4746

(11) 2187,2)913,08(,427 (12) 240,649)6109,2674(25,3866

85488
5820
4274
1546
1496
.. 50

481298
129628
120325
9303
7220
2083
1925
158
144
14
14

(13)6,84)14,44(2,11176+ (14)46,849)1694,647(36,172546

764 289177

804 80836

1204 339874

5204 119317

4164 256196

60 219514

321187

400093

(15) Divide 42,86 by ,8 (16) Divide 6,426 by 6,8

428 642

,8)3858 ,68)5,784(8,505882+

48,225

(17) 7414,864) 81869,8694(

741486 8186,9869

6673,378 73682,8825(11,0413

(18) 64,842)9,46946(

6,484 94694

58,358 8,52252(1460385+

(19) Divide 147,42683 by 8,467.

8,467)147,42683268

8 14742683

8,459) 147,27940585(17,41097+

(20) Divide 4176,4$\cancel{2}$66268 by 37,$\cancel{2}$697$\cancel{4}$.

37,$\cancel{2}$697$\cancel{4}$)4176,42$\cancel{6}$626$\cancel{8}$

37 4176426

37,26602)4176,0089842(112,0663+

51. REDUCTION OF DECIMALS.

CASE I.

(1) Thus 1,0÷4=,25; and 1,0÷2=,5 alſo 3,0÷4=,75.
(2) Thus $\frac{5}{24}$=5,000÷24=,208$\dot{3}$ the Decimal required.
(3) Firſt $\frac{5}{12}$ of $\frac{3}{4}$=$\frac{5}{16}$ per Caſe III. Sect. 41.
Then $\frac{5}{16}$=5,0000÷16=,3125 the Decimal required.
(4) Thus $\frac{4}{7}$=4,0÷7=,5$\dot{7}$14285$\dot{7}$ the Decimal required.
(5) Thus $\frac{2}{3}$=2,0÷3=,$\dot{6}$ the Decimal required.
(6) Firſt $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{7}{8}$=$\frac{21}{64}$;
Then $\frac{21}{64}$=21,000000÷64=,328125, the Decimal req.
(7) Firſt $\frac{1}{4}$ of $\frac{5}{12}$=$\frac{5}{48}$;
Then 5,00000÷48=,1041$\dot{6}$, the Decimal req.

CASE II.

(8) By Rule 1ſt. thus 17*s.* 6$\frac{3}{4}$*d.*=843 qrs.
And 1£.=960 ditto. Then $\frac{843}{960}$ or 843,0÷960 = ,878125 the Decimal required.

By Rule 2d thus;
4)3,00
12)6,75
2,0)17,5625
,878125

By Rule 3d thus,
17*s.* 6$\frac{3}{4}$*d.*
5 4
85 27+1=28
28
,878

First

(9) Firſt 6*s.* 9*d.*$=\frac{27}{80}$£. per Caſe VIII. Sect 41.
For 6*s.* 9*d.*= 27 Three-pences, and 1£.=80 ditto.
Then 80)27,0(,3375 the Decimal required.

(10) Thus $\frac{9}{21}$ or $\frac{3}{7}$=3,00000÷7=,42857+ Anſwer.

(11) Firſt 14*s.* 6½*d.*=349 Halfpence, and a Moidore=648 ditto.
Then 648)349,0(,53858+, the Decimal required.

(12) Firſt 18*s.* 4½*d.*=441 Halfpence, and 1£.=480 ditto.
Then 480)441,0(,91875, the Decimal required.

(13) Firſt ¾ of a Penny=$\frac{1}{320}$£. per Caſe VI. Sect 38.
Then 320)1,000(,003125, the Decimal required.

(14) Firſt 1lb.=240 dwts. 240)11,00(,04583, the Dec.req.

(15) Firſt 1lb.=256 drs. then 256)10,00(,03906+, the Dec.

(16) Firſt 3 qrs. 14lb.=98lb. then 112)98,0(,875 the Dec.

(17) A yd.=36 Inches, then $\frac{6}{36}$ or $\frac{1}{6}$=1,00÷6=,16, Anſ.

(18) Firſt a League, or 3 Miles = 24 fur. then $\frac{6}{24}$ or $\frac{1}{4}$= 1,00÷4=,25, Anſwer.

(19) Firſt 18 gal. 2 qts.=74 qts. and a hhd.=252 ditto.
Then 252)74,0(,29365+, the Decimal required.

(20) Firſt 3 qts. 1 pt.=7 pts. and a bar.=256 pts.
Then 256)7,00(,02734+, the Decimal required.

(21) Firſt an Acre=160 Perches, then $\frac{8}{160}$ or $\frac{1}{20}$=1,00÷20=,05, Anſwer.

(22) Firſt 4 buſh. 2 pks.=18 pks. and a chald.=144 do.
$\frac{18}{144}$ or $\frac{1}{8}$=1,000÷8=,125, Anſwer.

(23) Thus $\frac{12}{60}$ or $\frac{1}{5}$=1,0÷5=,2, the Decimal required.

(24) Firſt 12 Days=288 hrs. and 365 d. 6 h.=8766 do.
Then 8766)288,00(,03285+, the Decimal required.

CASE III.

(25) £. ,878125
20
s. 17,562500
12
d. 6,7500
4
qrs. 3,00

Anſwer, 17*s.* 6¾*d.*

(26) £. ,3375
×20
s. 6,7500
×12
d. 9,00

Anſwer, 6*s.* 9*d.*

Guinea.
(27) ,45
×7×3=21
3,15
3
9,45
12
d. 5,40
4
1,6
Answer, 9s. 5d. ¼,6.

Moidore.
(28) ,72708
×9×3=27
6,54372
×3
19,63116
12
d. 7,57392
4
2,29568
Answer, 19s. 7d. ½,29+

lb.
(29) ,00243
12
,02916
20
,58320
4×6=24
2,3328
6
13,99680
Answer, 14 Grs.

Ton.
(30) ,3375
20
cwt. 6,7500
4
qrs. 3,00
Anſ. 6 Cwt. 3 Qrs.

lb.
(31) ,0396
16
6336
16
drs. 10,1376
Anſ. 10 drs. 1376.

Cwt.
(32) ,875
4
Qrs. 3,500
28
lb. 14,0
Anſwer 3 Qrs. 14 lb.

Yard.
(33) ,16669
3
,50007
×12
6,00084
Anſ. 6 Inches+

League.
(34) ,259 ×
3
,777
8
Fur. 6,216
40
8,640
Anſ. 6 Fur. 8,64 Poles.

Hhd.

(35) *Hhd.* ,29365
×63
Galls. 18,5 nearly
Anſwer 18½ Galls.

(36) *Bar.* ,875
×32
28,000
Anſw. 28 Galls

(37) *Acre.* ,05
4
,20
40
8,00
Anſwer 8 Poles.

(38) *Chaldrons.* ,125
×36
Buſh. 4,500
4
Pks. 2,0
Anſ. 4 Buſh. 2 Pks.

(39) *Day.* ,4765
×24
Hrs. 11,4360
60
Min. 26,1600
60
Sec. 9,60
60
Thirds 36,00
Anſwer. 11 Hrs. 26 Min. 9 Sec. 36 Th.

52. EXTRACTION OF THE SQUARE ROOT.

(1) 74770609(8647 the Root.
64
166)1077
996=166×6
1724)8106
6896=1724×4
17287)121009
121009=17287×7

Proof thus, 8647×8647=74770609

(2)

(2) 60516(246 the Root required.
4
44)205
176
486)2916
2916

(3) 7658(87,5099, or rather 87,51+the Root.
167)1258
1745)8900
175009)1750000
1750189)17491900
Rem. 1740199

(4) 39342864(6272,389+the Root.
122)334
1247)9028
12542)29964
125443)488000
1254468)11167100
12544769)113135600
Rem. 232679

(5) 8209667940,5290(90607,21792 + the Root.

1806)10966

181207)1307940

1812142)3949152

18121441)32486890

181214427)1436544900

1812144349)16804391100

18121443582)49509195900

Rem. 13266308736

(6) ,000729(,027 the Root.
4

47)329

(7) 2)1,41421 + the Rt.
1

24)100

281)400

2824)11900

28282)60400

282841)383600

Rem. 100759

(8) 2,27109570(1,50701 +
1

25)127

3007)21095

301401)467000

Rem. 165599

(9) 36,00000625(6,0000005 + the Root.

120000005)625000000

Rem. 24999975

VUL-

54. VULGAR FRACTIONS.

(1) Thus $\sqrt{\frac{25}{81}}=\frac{5}{9}$, the Root required.

(2) Thus $\sqrt{\frac{225}{324}}=\frac{15}{18}$, or, $\frac{5}{6}$, the Root.

(3) Firſt $10\frac{39}{49}=\frac{529}{49}$. Then $\sqrt{\frac{529}{49}}=\frac{23}{7}$, or $3\frac{2}{7}$ the Root.

(4) Firſt $27\frac{9}{16}=\frac{441}{16}$. Then $\sqrt{\frac{441}{16}}=\frac{21}{4}$ or $5\frac{1}{4}$ the Root.

(5) Firſt $8\frac{3}{7}=8,4285714$. Then $\sqrt{8,4285714}=2,9032$, the Root.

(6) Firſt $\frac{597}{676}=,8831360946$. Then $\sqrt{8831360946}=$,93975+the Root.

(7) Firſt $76\frac{14}{17}=76,8235294$. Then $\sqrt{76,8235294}=$ 8,7649+the Root.

53. The USE of the SQUARE ROOT.

(1) Firſt $9\times4=36$. Then $\sqrt{36}=6$, the mean Proportion. For as 4 : 6 :: 6 : 9.

(2) Firſt $36\times16=576$. Then $\sqrt{576}=24$ the mean Proportion. For as 16 : 24 :: 24 : 36.

(3) Thus, $\sqrt[2]{4276,5}=65,395+$

(4) Firſt 9A. 2r. 15p.$=$1535 Perches. And $5,5\times5,5=$ 30,25 Yards in 1 Square Perch.

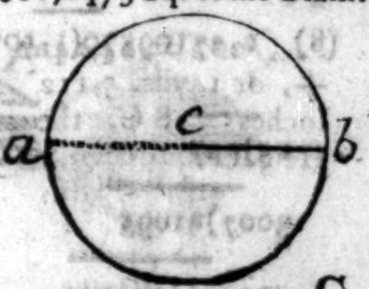
∵ $1535\times30,25=46433,75$ Yards the ſuperficial Cont.

Then $\sqrt{46433,75}=215,484918$ Yards $+=215$ Yards 1 Foot 5,467 inc. the Side required.

(5) Thus $\sqrt[2]{160}=12,649+$, the Side required.

(6) Firſt, As, 355 : 452 :: 4840 : 616,2479 Sq. of the Diam.

∵ $\sqrt{616,2479}=24,82+$ the Diameter required.



(7) Firſt $4840\times2=9680$ Yards. Content of the two Acres.

Then as 355 : 452 :: 9680

12324 Yards$=^{2}ab$.

∵ $\sqrt{12324}=111=ab$.

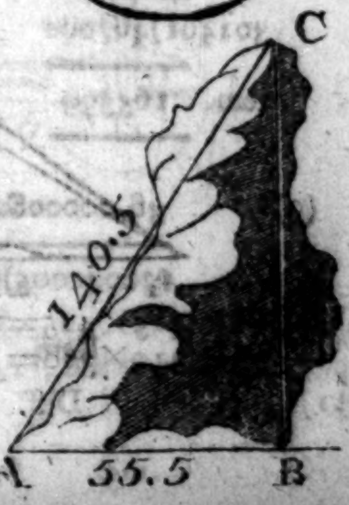
Therefore $111\div2=55\frac{1}{2}$ yds.$=$ *cb*, the Length of the Cord req.

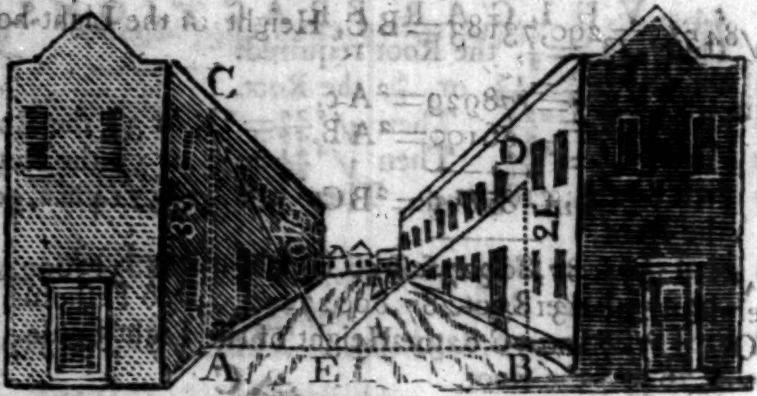
(8) Firſt $140,5\times140,5=19740,25$ ^{2}A C.

And $55,5\times55,5=3080,25$ ^{2}AB

^{2}B C$=16660$

∵ $\sqrt{16660}=129,07$ yds.$=$B C, the Height required.

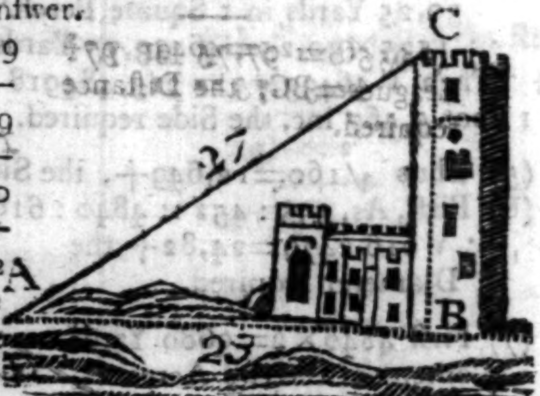


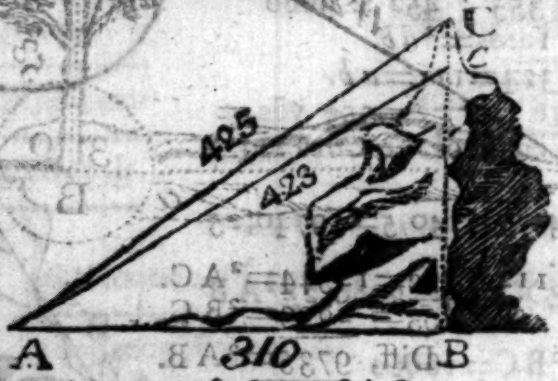


(9) First $40 \times 40 = 1600 = {}^2CE$, or ^2DE.
And $33 \times 33 = 1089 = {}^2AC$.
$\therefore \sqrt{511} = 22{,}6 = AE$.
Again $21 \times 21 = 441 = {}^2BD$.
Then $1600 - 441 = 1159 = {}^2EB$.
$\therefore \sqrt{1159} = 34{,}04 = B$.
Thereſore $22{,}6 + 34{,}04 = 56{,}64 +$ Ft. $= AE + EB$
$= AB$, the Anſwer.

(10) First $27 \times 27 = 729$
^2AC.
And $23 \times 23 = 529$
^2AB.
^2BC 200

$\therefore \sqrt{200} = 14{,}142$
$+$, or 14yds. 5,112
Inches $= BC$. the
Height required.





(11) First $425 \times 425 = 180625 = {}^2AC$.
And $310 \times 310 = 96100 = {}^2AB$.
Diff. $84525 = {}^2BC$.

$\therefore \sqrt{84525}=290,73183=BC$, Height of the Light-houſe and Rock.

Again $423\times423=178929={}^2Ac$.

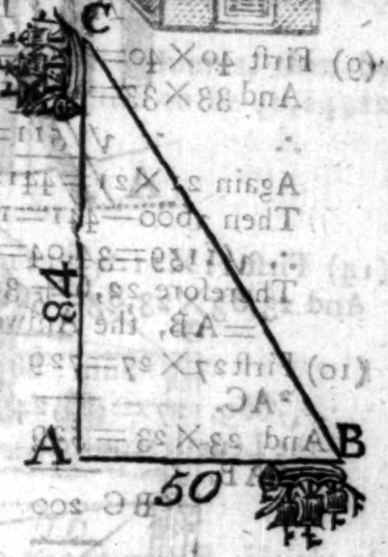
$-\ 96100={}^2AB$.

Diff. $82829={}^2BC$.

$\therefore \sqrt{82829}=287,80027=Bc$, Height of the Rock.

Therefore $290,73183-287,80027=2,93156$ Fathoms.

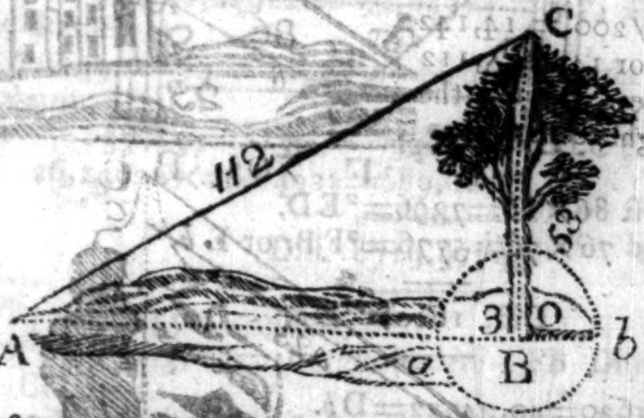
$\therefore$ Or 17 Ft. 7 In. $=Cc$. the Height of the Light-houſe.



(12) First $50\times50=2500={}^2AB$.
And $84\times84=7056={}^2AC$.

Sum $9556={}^2BC$.

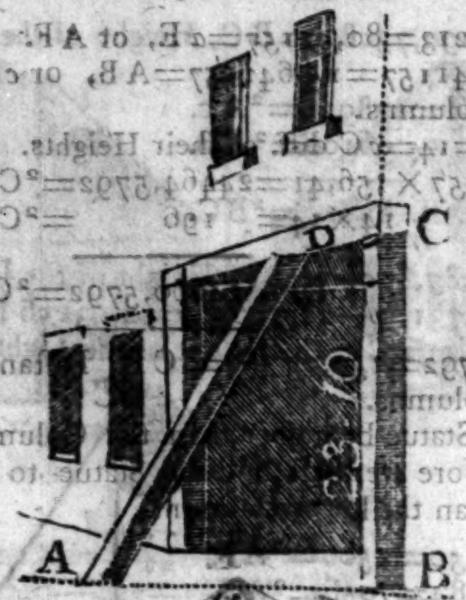
$\therefore \sqrt{9556}=97,75$ or $97\frac{3}{4}$ Leagues $=BC$, the Diſtance required.



(13) Firſt $112\times112=12544={}^2AC$.
And $53\times53=2809={}^2BC$.

Diff. $9735={}^2AB$.

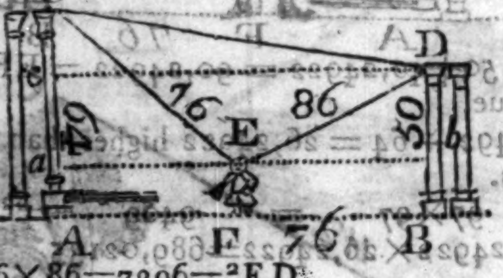
$\therefore \sqrt{9735}=98,6=AB$. Now $ab=30$. Which $\div2=15$ $=aB$. And $98,6-15=83\frac{2}{3}=Aa$, Brdth. of the Mt. req.



(14) First $11 \times 11 = 121 = {}^2AB$.
And $23,83 \times 23,83 = 568,027 = {}^2BC$.

Sum $689,027 = {}^2AC$.

$\therefore \sqrt{689,127} = 26,249$, or 26 Feet 29 Inches = AC, the Length required.



(15) First $86 \times 86 = 7396 = {}^2ED$.
And $76 \times 76 = 5776 = {}^2FB$, or Eb.

Diff. $1620 = {}^2Db$.

$\therefore \sqrt[2]{1620} = 40,24922 = Db$.
Alſo $50 - 40,24922 = 9,75078 = EF$. Height of Statue.
Likewiſe $64 - 9,75078 = 54,24922 = AC - Aa = aC$.
Again $97 \times 97 = 9409 = {}^2EC$.
And $54,24922 \times 54,24922 = 2942,97787 = aC$.

Diff. $6466,02213 = a^2E$, or ${}^2AF$.

∴ $\sqrt{6466,02213}=80,41157=aE$, or AF.

Now $76+80,41157=156,41157=AB$, or cD, Diſtance of the Columns.

And $64-50=14=cC$ diff. of their Heights.

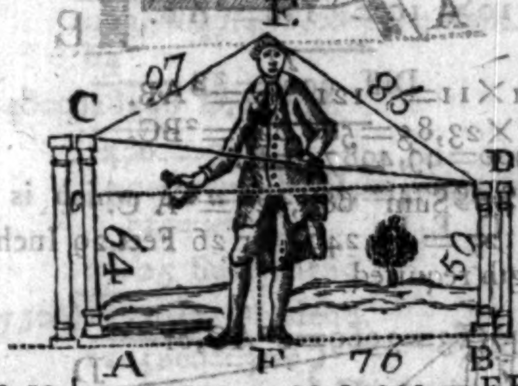
Now $156,41157\times156,41=24464,5792={}^2CD$

And $14\times14=196={}^2Cc$.

Sum $24660,5792={}^2CD$.

∴ $\sqrt{24668,5792}=157,03+=CD$, Diſtance of the Top of the Columns.

But if the Statue be higher than the Columns, then by working as before we ſhall find the Statue to be 40,24922 Feet higher than the lower Column.



Therefore $50+40,24922=90,24922=EF$, Height of the Statue.

Alſo $90,2492-64=26,24922$ higher than the higheſt Column.

Then $97\times97=9409={}^2CE$.

And $26,24922\times26,24922=689,02135$

Diff. $8719,97845$

∴ $\sqrt{8719,97845}=93,3808\ AF$.

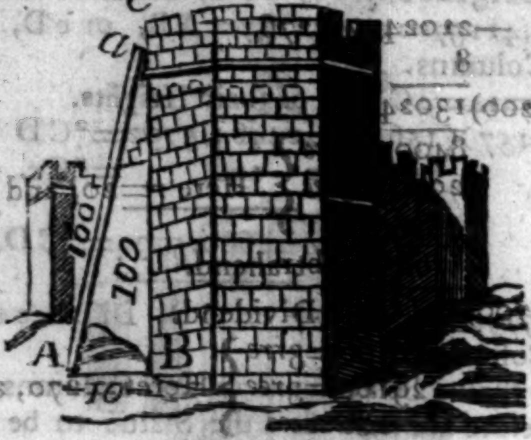
So that $76+93,3808=169,3808=AF+FB$ Diſtance of the Columns.

Again $1693,808\times169,3808=28689,8554864={}^2cD$.

And $14\times14=196={}^2cC$.

Sum $28885,8554864={}^2cD$.

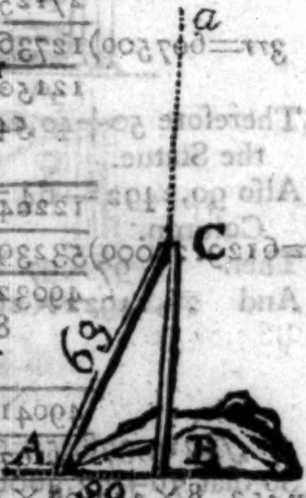
∴ $\sqrt{28885,8554864}=169,95839$ Ft. $=CD$, Diſtance required.



(16) Firſt $100 \times 100 = 10000 = {}^2Aa$.
And $10 \times 10 = 100 = {}^2AB$.

Diff. $9900 = {}^2Ba$.

Then $\sqrt{9900} = 99,49874 = Ba$.
∴ $100 - 99,49874 = ,50125 = aC$, which is 6 Inches nearly. Q. E. F.



(17) Firſt $63 \times 63 = 3969 = {}^2AC$, or CD.
And $30 \times 30 = 900 = {}^2AB$.

Diff. $3069 = {}^2BC$.

Then $\sqrt{3069} = 55,3985$ yds. $= BC$, Piece ſtanding.
∴ $63 + 55,3985 = 118,3985$ yds. or 118 Yds. 1 Foot $2\frac{1}{4}$ Inches $= Ba$, Height of the Pole.

(18) Thus $\sqrt{23716} = 154$ Men, the Anſwer.

54. THE

54. THE EXTRACTION OF THE CUBE ROOT.

(1) —21024576(276

8

$3rr=1200$)13024

8400 $=3rre$ }

2940 $=3ree$ } Here $r=20$, and $e=7$.

343 $=eee$ }

11683 Subtrahend.

$3rr=218700$)1341576 Dividend.

1312200 $=3rre$ }

29160 $=3ree$ } Here $r=270$, and $e=6$.

216 $=eee$ }

1341576 Subtrahend.

(2) 92398647(452,08+the Root.

64

$3rr=4800$)28398 Dividend.

24000 $=3rre$ }

3000 $=3ree$ } Here $r=40$, and $e=5$.

125 $=eee$ }

27125 Subtrahend.

$3rr=607500$)1273647 Dividend.

1215000 $=3rre$ }

5400 $=3ree$ } Here $r=450$, and $e=2$.

8 $=eee$ }

1220408

$3rr=612920000$)53239000000 Dividend.

49032960000 $=3rre$ }

8678400 $=3ree$ } Here $r=45200$, and $e=8$.

512 $=eee$ }

49041638912 Subtrahend.

4197361088 Rem.

Now 452, 8 × 452,08 × 452,08 + 4197361088 = 92398647, the Proof.

(3) 2716243264)1395,24+the Root.

$3rr=300$)1716 Dividend. } Here $r=10$, and $e=3$.

1197 Subtrahend. }

$3rr=50700$)519243 Dividend.
488619 Subtrahend.
} Here $r=130$, and $e=9$.

$3rr=5796300$)30624264 Dividend.
29085875 Subtrahend.
} Here $r=1390$, and $e=5$.

$3rr=583807500$)1538389000 Dividend.
1167782408
} Here $r=13950$, and $e=2$.

$3rr=58397491200$)370606592000 Dividend.
350400015576 Subtrahend
} Here $r=139520$, and $e=6$.

20206576424 Remains.

(4) 91)4,497 + the Root.

$3rr=4800$)27000 Dividend.
21184 Subtrahend.
} Here $r=40$, and $e=4$.

$3rr=580800$)5816000 Dividend.
5334849 Subtrahend.
} Here $r=440$, and $e=9$.

$3rr=60480300$)481151000 Dividend.
424022473 Subtrahend.
} Here $r=4490$, and $e=7$.

57128527 Remains.

(5) 67527834239)4072,18 + the Root.

$3rr=480000$)3527834 Dividend.
3419143 Subtrahend.
} Here $r=40$, and $e=7$.

$3rr=49694700$)108691239 Dividend.
99438248 Subtrahend.
} Here $r=4070$, and $e=2$.

$3rr=4974355200)9252991000$ Divid.
49744477361 Subtr.
} Here $r=40720$, and $e=1$.

$3rr=497459952300)4278513639000$ Divid.
3979757803232 Subtr.
} Here $r=407210$, and $e=8$.

298755835768 Remains.

(6) 4764,750)16,827+ the Root.

$3rr=300)3764$ Dividend.
3096 Subtrahend.
} Here $r=10$, and $e=6$.

$3rr=76800)668750$ Dividend.
645632 Subtrahend.
} Here $r=160$, and $e=8$.

$3rr=8467200)23118000$ Dividend.
16954568 Subtrahend.
} Here $r=1680$, and $e=2$.

$3rr=848737200)6163432000$ Divdend.
5943633293 Subtrahend.
} Here $r=16820$, and $e=7$.

219798717

(7) 36155,027576(33,0365

$3rr=2700)9155$
8937

$3rr=32670000)218027576$ Dividend.
196376616 Subtrahend.
} Here $r=3300$, and $e=6$.

$3rr=3278890800)21650960000$ Dividend.
19676915496 Subtrahend.
} Here $r=33060$, and $e=6$.

$3rr=328008106800$)1974044504000 Divid. } Here $r=330660$, & $e=5$.
1640065333625 Subtr.

333979170375 Remains.

(8) 67667,921875(40,75 the Root.

$3rr=480000$)3667,921 Dividend. } Here $r=408$, and $e=7$.
3419143 Subtrahend.

$3rr=49694700$)248778875 Dividend. } Here $r=4070$, and $e=5$.
248778875 Subtrahend.

(9) 219365329(603.1+ the Root.

$3rr=1080000$)3365329 Dividend. } Here $r=600$, and $e=3$.
3256227 Subtrahend.

$3rr=109082700$)109102000 Divid. } Here $r=6030$, & $e=1$.
109100791 Subtr.

1209 Remains.

(10) 3105926,917)145,9+ the Root.

$3rr=300$)2105 Dividend. } Here $r=10$, and $e=4$.
1744 Subtrahend.

$3rr=58800$)361926 Dividend. } Here $r=140$, and $e=5$.
304625 Subtrahend.

3*rr*=6307500)57301917 Dividend. } Here *r*=1450, and *e*=9.
57120579 Subtra.
181338 Remains.

(11) ,000421875),075 the Root.

3*rr*=14700)78875 Dividend. } Here *r*=70, and *e*=5.
78875 Subtrahend.

(12) 28022810,390625)303,7413+ the Root.

3*rr*=270000)1022810 Dividend. } Here *r*=300, and *e*=3.
818127 Subtrahend.

3*rr*=27542700)204683390 Dividend. } Here *r* = 3030, and *e*=7.
193244653 Subtrahend.

3*rr*=2767010700)11438737625 Divid. } Here *r* = 30370, and *e*=4.
11082607350 Subtr.

3*rr*=276773962800)369237001000 Div. } Here *r* = 303740, & *e*=7.
276774874021 Subt.

3*rr*=27677578524300)92462126979000 Div. } Here *r*= 3037470, and *e*=2.
830328175829997 Su.
9429309396003 Remains.

(13) First $\sqrt[2]{4857532416}=69696$.
Then $\sqrt[2]{69696}=264$ the biquadratic Root required.

(14)

(14) Firſt $\sqrt[2]{49656}=216$, then $\sqrt[3]{216}=6$, the ſquare cubed Root required.

(15) Firſt $\sqrt[2]{43046721}=6561$, again $\sqrt[2]{6561}=81$, alſo $\sqrt[3]{81}=9$ the Root.

(16) Firſt $\sqrt[3]{387420489}=729$. Then $\sqrt[3]{729}=9$, (the Root at the 9th Power.

57. To EXTRACT the CUBE ROOT of VULGAR FRACTIONS.

(1) Firſt $\frac{324}{1500}=\frac{27}{125}$, then $\sqrt[3]{\frac{27}{126}}=\frac{3}{5}$, the Root req.
(2) Firſt $\frac{352}{1188}=\frac{8}{27}$, then $\sqrt{\frac{8}{27}}=\frac{3}{2}$, the Root.

(3) Firſt $5\times125+104=729$, then $\sqrt[3]{\frac{729}{125}}=\frac{9}{5}$, or $1\frac{4}{5}$, Root.

(4) Firſt $405\times125+28=50653$, then $\sqrt{\frac{50653}{125}}=\frac{37}{5}\ 7\frac{2}{5}$, the Root.

(5) Firſt $5\frac{3}{5}=5{,}6$, then $\sqrt[3]{5{,}600}=1{,}775+$ the Root.

(6) Firſt $7\frac{5}{7}=7{,}7142857$, then $\sqrt[3]{7{,}7142857}=1{,}975$, the Root required.

55. The USE of the CUBE ROOT.

(1) Firſt $\sqrt[3]{21952}=28$ Side of the Cube.
Then $28\times28=784$, the Content required.

(2) $$\left.\begin{array}{ll}\text{First} & 125\times125\times125\\ \text{And} & 25\times\ 25\times\ 25\\ \text{Alſo} & 15\times\ 15\times\ 15\end{array}\right\}\times 3=\left\{\begin{array}{r}5859375\\ 46875\\ 10125\end{array}\right.$$

$\therefore\ \sqrt[3]{5859375}=180{,}28$ Keel.
And $\sqrt{46875}=36{,}05$ Midſhip-beam.
Alſo $\sqrt{10125}=21{,}6$ Depth in the Hold.

(3) $$\left.\begin{array}{ll}\text{First} & 125\times125\times125\\ \text{And} & 25\times\ 25\times\ 25\\ \text{Alſo} & 15\times\ 15\ \times15\end{array}\right\}\div 2=\left\{\begin{array}{r}976562{,}5\\ 7812{,}5\\ 1687{,}5\end{array}\right.$$

Which Numbers extracted will give 99,21; 19,84 and 11,905 the Dimenſions required.

(4) Firſt $75\times75\times75=421875$, and $100\times100\times100=1000000$.

Then, as 421875 C. K. : 300 Tons, :: 1000000 C. K. 711,1 Tons, or 711 Tons, 2 cwt. 24,64 lb. the Burthen required.

(5) Firſt $4\times4\times4=64$. Cube of the Diameter.

Then, as 18lb. : 64 inc. :: 114lb. : 405,3 inc. Cube of the Diameter.

∵ $\sqrt[3]{405,3}=7,4+$, the Diameter required.

(6) Firſt $11,5\times11,5\times11,5=1520,875$, and $20,83\times20,83\times20,83=9037,905787$.

Then, as 1520,875 : 1000 lb. : : 9037,905787 : 5942,5697 lb. +, the Weight required.

(7) Firſt $189\div7=27$, whoſe Cube Root is 3.

Then $3\times7=21$, the leſſer mean, and $21\times3=63$ the greater mean.

For, as 7 : 21 :: 63 : 189, the Proof.

(8) Firſt $256\div4=64$, then $\sqrt[3]{64}=4$, which × by $4=16$, the leſſer Mean, and $16\times4=64$, the greater.

For, as 4 : 16 :: 64 : 256, the Proof.

To EXTRACT THE FIRST SURSOLID ROOT.

RULE.

1. Having pointed the given Reſolvend into Periods of five Figures, ſeek ſuch a Surſolid Number in the Table, or otherwiſe, as comes neareſt to the firſt Period of the Reſolvend, whether greater or leſs; and call the reſpective Root, either more than juſt, or leſs than juſt, as it falls out; annexing ſo many Cyphers to it, as there are remaining Periods of whole Numbers in the Reſolvend.

2. Find the Difference between the Reſolvend and the Surſolid Number, ſo taken, by ſubtracting the leſſer from the greater.

3. Find the Cube of the aforeſaid Surſolid Root, with its annexed Cyphers, which alſo may be done by the Table,

and multiply that Cube into five, the Index of the Surſolid, and divide the difference between the Reſolvend and the Surſolid Number by that Product; by which it will be depreſſed to a Square, and when pointed into Periods of two Figures each, call it the new Reſolvend.

4. Make the firſt Root without Cyphers a Diviſor, enquiring how often it may be found in the firſt Period of the new Reſolvend; with this Conſideration, if the Root now a Diviſor, be leſs than juſt, annex twice the Quotient Figure to it; but if more than juſt, ſubtract twice the Quotient Figure from a Cypher, either annexed or ſuppoſed to be annexed, to that Diviſor or Root, multiplying it ſo increaſed or diminiſhed, with the ſaid Quotient Figure: ſetting down the Units Place of the Product under the pointed Figure of that Period, ſubtracting it as in Diviſion.

TABLE.

1		3	4	5	6	7	8	9
1	123	43	1024	3125	7776	16807	32768	59040

EXAMPLES.

(1) Extract the Surſolid Root of 12309502009375, the Reſolvend pointed.

The neareſt Surſolid Number to 1230, the firſt Period of the Reſolvend, is 1024, whoſe Root is 4 (by the Table) leſs than juſt.

Therefore 12309502009375
—1024

2069102009375 their Difference.

Now as there are two Periods remaining in the Reſolvend, place two 0's to 4, the Root of the firſt Period.

Next the Cube of 400=64000000.

And 64000000×5=320000000 the Diviſor.

Then 320000000)2069502009375(6497, &c.

Firſt Root = 400
+2 × 10 = 20

1ſt Diviſor = 420)6467(15 laſt Root.
+20 × 2 × 5 = 30 42   400 Firſt.

450)2267(415 Root (true) required.
2250

Rem. 17 to be rejected.

Now 415 × 415 × 415 × 415 × 415 = 12309502009375, the Proof.

(2) Extract the Surſolid Root of 23278345598 73.

Now the neareſt Surſolid Number to 232 is 243 (per Term) whoſe Root is 3, being more than juſt.

Therefore 243000000000
−23278345598 73

Rem. 102165440127 for a Dividend.

300 Cubed = 27000000, which × 5 = 135000000 Diviſor.
Then 135000000)102165440127(756,7810 new Reſolvend.
Firſt Root 300
−2 × 2 = −4
300 firſt Root.
1 Diviſor = 296)756,7810(2,566 laſt ditto, too much.
−4 −2 × ,5 = −5,0 592
2 97,434 the Root only too little by 2 in the loweſt Figure.
2 Diviſor = 291,0)164,78(
−1 −2 × 00 = −1,12 145,50

3 Diviſor = 289,88)19,2810(
&c. &c.

To EXTRACT THE ROOT OF THE SECOND SURSOLID, OR SEVENTH POWER.

RULE.

Having pointed the Reſolvend into Periods of ſeven Figures, ſeek out ſuch a Number by the Table, as comes neareſt to the firſt Period of the Reſolvend, whether greater or leſſer, calling its Root more than juſt, or leſs than juſt, annexing a proper Number of Cyphers.

2. Find the difference between the Reſolvend and that Number of the ſeventh Power, by ſubtracting the leſſer from the greater.

3. Find the Surſolid or fifth Power of that Root, with its annexed Cyphers, by the Table; and multiply that Surſolid Number into ſeven, the Index of the Reſolvend.

4. Make that Product a Diviſor, by which the aforeſaid Difference muſt be divided; ſo that it may be depreſſed to a Square, and pointed as ſuch.

5. Make the firſt Root without a Cypher, a Diviſor, working with it and the new Reſolvend, as in Surſolid, only here you muſt increaſe or diminiſh the Diviſor with three quotient Figures.

TABLE.

	2	3	4	5	6	7	8	9
1	128	2187	16384	78125	279936	823543	2097152	4782969

EXAMPLE.

What is the ſecond Surſolid Root of

382986553955078125 Reſolvend pointed.
—2187 the neareſt of the ſeventh Power.
164286553955078125 their Difference.

The firſt Root is 300, being leſs than juſt, and the fifth power of 300=2430000000000, which being multiplied by 7=17010000000000 for a Diviſor, by which the aforeſaid Difference muſt be divided, which contracted may ſtand thus (1701) 16428655 (9658,23, &c.

First Root = 300
3 × 20 = + 60
. . 300
1 Divisor = 360)9658(25

60 + 3 × ,05 = + 75 72 325 the true Root.

2 Divisor = 435)2458
2175

Rem. 283 to be rejected.

56. THE RULE OF THREE IN DECIMALS.

(1) First 6*s.* 3*d.*=,3125£. and $4\frac{3}{4}$=4,75 Yards. Also $48\frac{1}{2}$=48,5 Yards.

Then, as 4,75 : 3125 :: 48,5 : 3,19078 or £.3 3,$9\frac{3}{4}$ the Answer.

(2) First $2\frac{1}{2}$*lb.*=2,5. And 1£. 5*s.*=1,25. Also $14\frac{3}{4}$= 14,75.

Then, as 2,5*lb.* : 1,25£. :: 14,75*lb.* : 7,375=7£. 7*s.* 6*d.* the Answer.

(3) First 1*lb.*=,00892858*C.* $11\frac{3}{4}$*d.*=,0489583£.

And 4*hhds.* each 4 *C.* 2*qrs.* 14*lb.*=4,625×4=18,5 *C.*

Then, as,00892857 : ,0489583£. :: 18,5*C.* : 101,4417£. =101£. 8*s.* 10*d.* the Answer.

(4) First 4 Chests each, 2*C.* 3*qrs.* 14*lb.*=2,875 *C.* × 4= 11,5*C.* And 906£. 10*s.*=906,5£.

Then, as 11,5 : 906,5 :: ,00892857 : 7038=14*s.* $\frac{3}{4}$d. ,6. the Answer.

(5) As *D.* *M.* *D.*
2 : 12 : : 9,6
× 12

116,0 } See Case 4, p. 165
116 } G.

3)1044

Answer 348 Miles.

(6) Firſt, from 4 Tuns, 201½ gal. take 24½ gal. remains 4 Tuns, 177 gal. or 1185 gal.
And £. 240 16s. 6d. = 240,825 £.
As, 1185 : 240,825 :: 1 : ,20322, or 4s. ¾d. nearly.

(7) Firſt $4\frac{74}{125}$ = 4,592, which ÷ 12 = ,3826, ft. this added to 10 ft. = 10,3826 ft. = to 6,5 Cubits.
Then, as 6,5 cub. : 10,3826 :: 1 cub. : 1,5973 = 1 ft. 7,168 Inches, the Anſwer.

(8) Firſt 78,4 ÷ 8 = 9,8, the ſecond Number.
Then, as 5 : 9,8 :: 8 : 15,68, the fourth Number.
∵ 15,68 — 9,8 = 5,88, the Anſwer.

(9) Firſt 13⅓ = 13,3. And 13,3 × 282 = 3760 Cubic Inches, the Content of the Caſk.
Then 3760 × ,52835 = 1986,596 oz. Weight of the Oil.
Which ÷ 16 = 124,16225 lb. Alſo 7½ = 7,5 lb. Weight of 1 gall.
Therefore, as 7,5 lb. : 1 gall. :: 124,16225 lb. : 16,555 = 16 gall. 2 qts. 4 pts. the Anſwer.

(10) Firſt 4,63 — 1,5688 = 3,0612 oz. Difference.
And a ſolid Foot and Half, = 1728 + 864 = 2592 ſolid in.
Then, as 1 inc. : 3,0612 oz. :: 2592 inc. : 7934,6304 oz. = 4,4278 cwt. or 4 cwt. 1 qr. 19 lb. 14 oz. 9,88 drs. Anſwer.

(11) Now, as 5 : to 8 :: 75 : 120, the greater Number.
Then 75 + 120 = 195, their Sum.
And 120 — 75 = 45, their Difference.
Alſo 195 × 45 = 8755, Prod. of their Sum and Diff.
120 × 120 = 14400, Square of the gr. and 75 × 75 = 5626 of the leſſer.
14400 — 5625 = 8775, Diff. of thoſe Squares.
14400 + 5625 = 20025, Sum of ditto.
120 ÷ 75 = 1,6, Quot. of the gr. divided by the leſſer.
75 ÷ 120 = ,625, Quot. of the leſſer div. by the greater.
1,6 × 1,6 = 2,56, Square of the greater Quote.
,625 × ,625 = — ,390625, Square of the leſſer Quote.

Anſw. 2,950625 Sum of thoſe Squares.

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(12) Now, as 8 : 7 :: 224 : 196, the leſſer Number.
Then 224 + 196 = 420, their Sum.
And 420 × 420 = 176400, Square of their Sum.

Alſo 240—196=28, Diff.

28×28=784. Square of that Diff.

224÷196=1,148256, Quot. of greater ÷ leſſer.

196÷224=,875, Quot. of the leſſer ÷ greater.

1,142856×1,142856=1,30612+ } Square of thoſe
,875 × ,875 = ,765625 } Quotes.

420×28+28=11788, Prod. of their Sum and Difference, and the Diff. added.

Laſtly, 11788×11788=138956944, Square of the Sum of their Diff. added to the Prod. of their Sum and Diff.

Miles.

(13) He that rows towards } London goes { 7,5 } per Ho.
And he that rows from } London goes { 2,5 } per Ho.

Sum=10

∴ 34÷10=3,4 Hours, before they will meet.

Then, as 1 h. : 2,5 m. :: 3,4 h. : 8,5, or 8½ Miles from London.

And 34—8½=25½ Miles from Chertſey, the Anſwer.

(14) Firſt 13,5—7,5=6 Inches, Diff.

Then, as 4 : 9 :: 6 : 13,5 lb. the Anſwer.

(15) Firſt 18200£. at 3 per Cent.=546£. ſpent on the Funeral and Monument.

Then 18200—546=17654£. left.

Again 17654£. at 9£. per Cent.=1588,86 gave to his Couſins.

Then 17654—1588,86=16065,14£. what he had then left.

Again $\frac{2}{7}$ of 16065,14=4590,04£. paid for the Seat

Then 16065,14—4590,04=11475,1 left.

Again 11476,1÷8=1434,3875 paid for Horſes.

Then 11475,1—1434,3875=10040,7125 left.

Alſo 10040,7125—550£.=9490,7125 left, after he had ſpent 550£. on his Miſtreſs.

Now, as 12 : 2000 :: 29 : 3166,6£. ſpent in riotous Living,

∴ 9490,7125—3166,6=6324,0458 3£. or 6324£. 11*d.* the Anſwer.

(16) Firſt 6×6=36. And 3×3=9 Square of their Diſtances.

Then, Recip. as 36 : 1 :: 9 : 4, ſo that A's Place is four Times as hot as B's.

(17) Firſt 81000000×81000000=6561000000000000.

Then, Recip. as

1 : 6561000000000000 :: 2 : 3280500000000000.

∵ $\sqrt[2]{3280500000000000}=57275649$ Miles, the Anſw.

Squares of their Diſtances; the Cyphers being omitted.

(18) Firſt 81 + 81 = 6561. And 424 × 424 = 179776

Squares of their Diſtances; the Cyphers being omitted.

Then, Recip. as 179776 : 1 :: 6561 : 27,4; ſo that the Sun's Influence on the Earth to that on the Planet Jupiter, is as 27,4, to 1.

(19) Firſt 32×32=1024. And 777×777=603719, the Squares of the Diſtances, Cyphers omitted.

Then, Recip. as 603729 Sat : 1 :: 1024 : 589,584 Merc. nearly.

∵ The Solar Influence on Mercury to that of Saturn, is as 589,584 to 1, nearly.

(20) Firſt 115×115×=13225 Square.

As 13225 : 1 :: 2 : 13225 Degrees hotter.

(21) The Square Roots of the Diſtances being as the Times. viz. as the $\overline{\sqrt{1} : \sqrt{2}}$ :: is the Time of falling through the whole required Height.

Now the $\sqrt[2]{1}=1$, and $\sqrt[2]{2}=1,4142$, from which take 1. Remains ,4142.

∵ As ,4142 : 1,4142 :: 1 : 3,414 Secs. the Deſcent; the Square of which is 11,6574.

Then as $^{2}1$: 16,083 :: 11,6574 : 187,48 ft. the Tower's Height.

(22) Firſt 7970×7970×7970=506261573000.

And 2170×2170×2170=10218313000.

Then, as 10218313000 : 506261573000 :: 1 : 49,5445, Times bigger than the Moon.

∵ As 132,5 : 100 :: 49,5445 : 40,117, Q. E. F.

That is the Earth contains 40,117 Times more Matter than the Moon.

(23) Firſt 81000000+240000=81240000, Sun from a full Moon.

And 81000000−240000=80760000, Sun from a new Moon.

$$\text{Now}\left\{\begin{array}{l}8124\times8124=65999376\\8076\times8076=65221776\end{array}\right\}$$ Squares of their Diſtances, Cyph. omitted.

Recip. As 65221776 : 1 :: 65999376 : ,9882.

So that the Proportion of Light, and Heat, a new Moon has to that of a full one, is

As 1 to ,9882, or as 458829 to 452929 in whole Numbers.

(24) Firſt 11×11=121, and the Square of 1 is 1.
Then, As 1 : 16,083 :: 121 : 1946,083, Q. E. F.

$$\text{Or}\quad 16{,}083 \times \left\{\begin{array}{l} 1=16{,}083 \\ 3=48{,}25 \\ 5=80{,}416 \\ 7=112{,}583 \\ 9=144{,}75 \\ 11=176{,}916 \\ 13=219{,}083 \\ 15=241{,}25 \\ 17=273{,}416 \\ 19=305{,}583 \\ 21=337{,}75 \end{array}\right\} \text{in the} \left\{\begin{array}{l} \text{1ſt.} \\ \text{2d.} \\ \text{3d.} \\ \text{4th.} \\ \text{5th.} \\ \text{6th.} \\ \text{7th.} \\ \text{8th.} \\ \text{9th.} \\ \text{10th.} \\ \text{11th.} \end{array}\right\} \text{Sec. of Time.}$$

Anſw. 1946,083 as before.

(25) Firſt 10×10=100, and 6×6=36, Square of their Deſcents.

$$\text{Then, As } 1 : 16{,}083 :: \left\{\begin{array}{l} 100 : 1608{,}3 \\ 36 : \underline{579} \end{array}\right\} \text{their Depths.}$$

Anſwer, 1029,3

(26) Firſt 19,5×19,5=380,25 ſq. of the Deſcent.
Then As $^{2}1$: 16,083 :: 380,25 : 6115, 6875 Feet.
Which ÷6=1019 faths. 1 ft. 8½ inc. Q. E. F.

(27) Thus, As ,16,083 : $^{2}1$ :: 400 : 24,8702.
∵ $\sqrt[2]{24{,}87002}=4{,}987+$, or 5 ſecs. nearly, the Anſw.

(28) The Semi diameter of the Earth = 3980 Miles, or 21014400 ft.
Then, As 16,083 : 1^{2} :: 21014400 : 1306594,82.
∵ $\sqrt{1306594{,}82}=1135{,}554$ ſec. = 18 min. 55″ 33‴.
Q. E. F.

57. THE DOUBLE RULE OF THREE IN DECIMALS.

(1) Firſt, As 1,1£. : 12 Per. :: 1,6£. : 17,45 Perſons.
Then Recip. As 25,2£. : 17,45 :: 18,9£. : 23 Perſons, nearly, the Anſwer.

(2) As 19lb. : 42,5 lb. :: 13 lb. : 2,908 lb.
Alſo 2,908 : 6 :: 10 : 20,6334 lb. worth 63 lb. at 5*d.* per *lb.*=63×5=315*d.* or 1,3125£.

Then, As 20,634 : 1,3125£. : : 112 lb. : 7,12437£. = 7£. 2*s.* 5¼*d.* 9 (nearly) the Anſwer.

$$\begin{array}{llll|l} & \text{£.P.} & \text{yr.} & \text{I.} & \\ (3) & 100 \;. & 1 \;. & 3{,}5 & \text{Then } \dfrac{100\times1\times38{,}5}{3{,}5\times1{,}25}=\dfrac{3850}{4{,}375}\text{£.} \\ & \text{—} & 1{,}25 & 38{,}5 & =880\text{£. the Anſwer.} \end{array}$$

(4) Firſt from Decemb. 11th. to May 10th. = 150 Days.
And from Sept. 3d. to Chriſtmas-Day = 113.
Alſo 91 Guin. = 95,55£. and 100 Mar. = 66,6£.
Then, As 95,55£. : 150 Days, :: 66,6£. 215 Days.
∵ 215—113 = 102 Days.
Recip. As 66,6 : 102 : 40£. 169,13 Days, or rather 170 Days, the Anſwer.

(5) *Days.* *w.*

$$\text{As}\begin{cases}12\\14\\15\\18\end{cases}\begin{matrix}\textit{Work. Day}\\ : 1 : : 1 :\end{matrix}\begin{cases}\frac{1}{12}=,0833333=\text{A.B. C.}\\ \frac{1}{14}=,0714285=\text{B.C. D.}\\ \frac{1}{15}=,0666666=\text{A.C.D.}\\ \frac{1}{18}=,0555555=\text{A.B. D.}\end{cases}\text{Will do Part of the whole Work.}$$

All working three Days will do ,276984 Part of the Work.

Then, As,276984 : 3 :: 1 : 10,8309505 Days, all working

14 = B. C. D.
—10,83095 A. B. C. D.

As 3,16905 : 10,8395 : : 14 : 47,848 Days by A.

15 = A. C. D.
—10,83095

As 4,16905 : 10,8395 : : 15 : 38,969 Days by B.

18 = A. B. D.
—10,83095

As 7,16905 : 10,8395 : : 18 : 27,194 Days by C.

12 = A. B. C.
—10,83025

As 1,16905 : 10,8395 :: 11 : 111,1766 Days by D.

alone.

(6)

(6) Firſt 34″=,009444 ho. and 5 Rods,=,015625 Miles.
Then, as 1 ho. : 12 Miles, : : 009444 ho. : ,113328m.
∴ ,113328+,015625=,128953 m. or 680,9 ſt. the Hare had ſtarted.

Now 20—12=8, Dog gained in running 20.

Again, As 8 : 20 : : ,12895 : 2,57906 ſur.=1702¼ ſt. run by the Greyhound.

∴ As 8 : 1 ho. : : 128953 m. : ,016119 ho.=58″,0284, run by the Greyhound.

1. VIBRATION of PENDULUMS.

(7) Receip. As 3600 : 39,2 : : $\left\{\begin{array}{r} 900 : 156,8. \\ 14400 : 9,8. \end{array}\right.$

Anſwer, Inches 147

(8) Recip. As 39,2 : 3600 : : $\left\{\begin{array}{r} 12 : 11760. \\ 6 : 23520. \end{array}\right.$

∴ $\sqrt[2]{11760}$=108,444, and $\sqrt[2]{23520}$=153,362.
Then 153,362×60 = 9201,72
And 108,444×60 = 6506,64

Anſwer 2695,08 the Difference.

(9) A Pendulum which vibrates 60 Times in a Minute, will vibrate 60×60=3600 Times in an Hour; the Square of which = 12960000, and the Square of 30=900; alſo of 100=10000. Then Recep.

12960000 : 39,2 inc. : : $\left\{\begin{array}{r} 900 : 564480 \\ 10000 : 50803,2 \end{array}\right.$

12)513676,8 Inches.

Anſwer Diff. 42806,4 Feet.

(10) Firſt a Pendulum which vibrates Thirds, will vibrate 60 Times in a Second.

∴ As 1^2 : 39,2 : : 60^2 (3600) : ,0108 inc. the Length of that which vibrates Thirds.

Secondly, a Pendulum which vibrates Seconds, will make 60 Vibrations in a Minute.

∵ As 60^2 (3600) : 39,2 : : $^2 1$: : 11760 inc. $= 2\frac{5}{22}$ Miles, the Length of a Pendulum which vibrates once in a Minute.

Thirdly, a Pendulum which vibrates Seconds, will make $(60 \times 60) = 3600$ Vibrations in an Hour.

∵ As 3600^2 (12960000) : 39,2 : : $^2 1$: 508032000 inc. $= 8018\frac{2}{11}$ Miles, the Length of the Pendulum, which vibrates once in an Hour.

Laſtly, a Pendulum which vibrates Seconds will make $(60 \times 60 \times 24) = 86400$ Vibrations in a Day, or 24 Hrs.

∵ As 86400^2 (7464960000) : 39,2 :: $^2 1$: 292626432000 inc. $= 4618188\frac{1532}{1760}$ Miles, the Length of a Pendulum, which vibrates once in a Day.

(11) Firſt $60 \times 60 = 3600$.

Then, As 39,2 inc. : 3600 ſec. :: 18 inc. : 7840 ſec.

∵ $\sqrt{7840} = 88,54378$ Vibrations in one Minute.

Then 60)88,54378(1,475729 Vibrations in a Second.

Alſo 1,475729)8,000000(5,421 ſec. in eight Vibrations.

Now $5,421 \times 5,421 = 29,387$.

Then, As $^2 1$: 16,083 ft. :: 29,387 : 472,640916 ft. Sound was returning.

Again, As 1150 ft. : 1 ſec. :: 472,640916 : ,41099″, Time Sound was returning.

∵ $5,421 - ,411 = 5,01$ Seconds, Time of the Body's Deſcent.

And $5,01 \times 5,01 = 25,1$. Alſo $25,1 \times 16,083 = 403,69$ ft. the Depth of the Well.

58. FELLOWSHIP.

(1) Firſt, $750 + 450 + 300 = 1500$ the whole Stock.

And 300£. $\div 1500 = ,2$ the Quotient. Then

$$\left.\begin{matrix}750\text{ A's}\\459\text{ B's}\\300\text{ C's}\end{matrix}\right\}\text{Stock} \times ,2 = \left\{\begin{matrix}150\text{ A's}\\90\text{ B's}\\60\text{ C's}\end{matrix}\right\}\text{gain.}$$

Proof 300£.

$$\text{(2) First}\left\{\begin{matrix}120\\250\\100\end{matrix}\right\} \times \left\{\begin{matrix}8\\4\\5\end{matrix}\right\} = \left.\begin{matrix}960\text{ A's}\\1000\text{ B's}\\500\text{ C's}\end{matrix}\right\}\text{Stock and Time.}$$

Sum 2460)184,5(,075 the Quote.

Then

$$\text{Then}\left\{\begin{array}{r}960\\1000\\500\end{array}\right\}\times{,}075=\left\{\begin{array}{r}72\\75\\37{,}5\end{array}\right\}\begin{array}{l}\text{A's}\\\text{B's}\\\text{C's}\end{array}\Big\}\text{Gain.}$$

Proof 184,5 = £. 184 10 0

(3) Firſt 229£. 13*s.* 4*d.*=229,*6*; $5\frac{5}{9}$=5,*5*; $4\frac{3}{7}$=4,428571 × ,$4\frac{1}{9}$=4,*1*; and $3\frac{2}{3}$=3,*6*.

Then Nell takes up 3,*6*, as often as Anne takes up 4,*1*; then as often as Moll takes up 5,*5*, Anne takes up 4,428571; and Nell muſt take

$$\frac{3{,}6\times4{,}428571}{4{,}1}=3{,}949809.$$

For, As 4,1 : 3,6 : : 4,428571 : 3,949809.

$$\begin{array}{rl}\text{Hence Moll takes} & 5{,}555555\\ \text{Anne} & 4{,}428571\\ \text{And Nell} & 3{,}949809\end{array}\Bigg\}\text{Ratio of their Shares.}$$

$$\text{Sum } 13{,}933935$$

$$\begin{array}{l}\therefore\ \text{As } 13{,}933935 :\\ 229{,}6£. : :\end{array}\left\{\begin{array}{lrrrl} & & £. & s. & d.\\ 5{,}555555 : 91{,}569 = & 91 & 11 & 4\frac{1}{4} & \text{M.}\\ 4{,}428571 : 72{,}995 = & 72 & 19 & 10\frac{3}{4} & \text{A.}\\ 3{,}949809 : 65{,}102 = & 65 & 2 & \frac{1}{2} & \text{N.}\end{array}\right.$$

59. SIMPLE INTEREST.

Theorem I. P t r = I. the Intereſt.

(1) Here is given P=260,875, t=5,5 and r=,045.

Then per Theo. 260,875×5,5×,045=64,5665625 = 64£. 11*s.* 3½*d.* ,9, the Intereſt required.

(2) Firſt, from May 12, 1764, to Nov. 24, 1769, is 5 yrs. 196 ds. or 5,536986 yrs.=t, r=,0375, and P=500.

Then per Theo. 5,536986×,0375×500=103,8184875 =103£. 16*s.* 4¼*d.* ,48 the Anſwer.

When the Intereſt is for Days.

(3) Here r=,00012328767, t=,220 and P=370,5.

Then per Rule ,00012328767×370,5×220=10,049+ =10£. 11¾*d.* the Intereſt required.

(4) Firſt, from July 1, to Feb. 24, following, is 238 Days, =t, P=600, and r=,00016438356.

Then 00016438356×238×600=23,47897223628=23£. 9*s.* 5¼*d.* the Intereſt.

Theorem II. $Ptr + P = A$, the Amount.

(5) Here $P = 284{,}5$, $t = 7$, and $r = {,}035$.

Then per Theo. $284{,}5 \times 7 \times {,}035 + 284{,}5 = 354{,}2025 =$ 354£. 4s. ½d. ,4, the Amount required.

(6) Here $P = 672{,}25$, $t = 5{\cdot}5$ and $r = {,}045$.

Then per Theorem, $672{,}25 \times 5{,}5 \times {,}045 + 672{,}25 =$ $838{,}631875 =$ 838£. 12s. 7½d. ,6, the Anſwer.

(7) Here $P = 500$, $t = 6{,}328767$, and $r = {,}0475$.

Then per Theorem VI. $328767 \times {,}0475 \times 500 + 500 =$ $650{,}30821625 =$ 650£. 6s. 1¼d. 8+, the Amount.

Theorem III. $\frac{I}{t\,r} = P$, the Principal.

(8) Here $I = 69{,}675$, $t = 3$, and $r = {,}05$.

Then per Theo. $\frac{69{,}675}{3 \times {,}05} = \frac{69{,}675}{{,}15} = 464{,}5 =$ 464£. 10s. the Principal.

(9) Here $I = 64{,}35$, $t = 5{,}5$, and $r = {,}045$.

Then per Theo. $\frac{64{\cdot}35}{5{\cdot}5 \times {,}045} = \frac{64{,}3500}{{,}2475} =$ 260£. the Anſ.

(10) Here $I = 67{,}790625$, $t = 4$ and $r = {,}04$.

Then per Theo. $\frac{67{,}790625}{4 \times {,}04} = \frac{67{,}790625}{{,}16} =$ 423£. 13s. 9¼d. ,75+, the Principal required.

Theorem IV. $\frac{a}{tr + 1} = P$, the Principal.

(11) Here $a = 354{,}2208\dot{3}$, $t = 7$, and $r = {,}035$.

Then per Theo. $\frac{354{,}2208\dot{3}}{{,}035 \times 7 + 1} = \frac{334{,}22083}{1{,}245} = 284{,}5147$ $=$ 284£. 10s. 3½d. ,112, the Anſwer.

(12) Here $A = 500{,}46041\dot{6}$, $t = 6{,}41\dot{6}$, and $r = {,}05$.

Then per Theo. $\frac{500{,}46041\dot{6}}{6{,}41\dot{6} \times 05 + 1} = \frac{500{,}460416}{1{,}3208\dot{3}} =$ $378{,}89826+ =$ 378£. 17s. 11½d. ,2296, the Anſwer.

(13) Here $A = 100$, $t = 7{,}6027397$, and $r = {,}0475$.

Then per Theo. $\frac{100}{7{,}6027397 \times {,}0475 + 1} = \frac{100}{1{,}36113} =$ $73{,}4675+ =$ 73£. 9s. 4d. ,2, the Principal.

Theo.

Theorem V. $\frac{I}{pr}=t$, the Time.

(14) Here $I=69{,}675$, $P=464{,}5$, and $r=,05$.

Then per Theo. $\frac{69{,}675}{464{,}5\times,05}=\frac{69{,}675}{23{,}225}=3$ yrs. the Time required.

(15) Here $I=64{,}45$, $P=260$, and $r=,045$.

Then per Theo. $\frac{64{,}35}{260\times,045}=\frac{64{,}35}{11{,}7}=5\frac{1}{2}$ yrs. the Anſw.

(16) Here $I=130{,}47516$, $P=500$, and $r=,065$.

Then per Theo. $\frac{130{,}47936}{,065\times500}=\frac{130{,}47516}{32{,}5}=4{,}0144+=4$ Years, 5,25 Days, the Anſwer.

Theorem VI. $\frac{a-P}{Pr}=t$, the Time.

(17) Here $a=354{,}2208\text{ʒ}$, $P=284{,}5$, and $r\times,0325$.

Then per Theo. $\frac{354{,}2208\text{ʒ}-284{,}5}{284{,}5\times,0325}=\frac{70{,}7208\text{ʒ}}{9{,}24625}=7{,}65405+=7$ Years, 238,7 Days, the Anſwer.

(18) Here $a=847{,}875$, $P=672{,}25$, and $r=,0475$.

Then per Theo. $\frac{847{,}875-672{,}25}{672{,}25\times,0475}=\frac{175{,}625000}{31{,}931875}=5\frac{1}{2}$ ys. the Anſwer.

(19) Here $a=500{,}46458\text{ʒ}$, $P=378{,}9$, and $r=,05$.

Then per Theo. $\frac{500{,}46458\text{ʒ}-378{,}9}{378{,}9\times,05}=\frac{121{,}56458\text{ʒ}}{18{,}945}=6{,}41467=6$ Years, 5 Months, (nearly) Anſwer.

Theorem VII. $\frac{I}{pt}=r$, the Rate.

(20) Here $I=69{,}675$, $P=464{,}5$, and $t=3$.

Then per Theo. $\frac{69{,}675}{494{,}5\times3}=\frac{69{,}675}{1393{,}5}=,05$, or 5 per Ct. the Rate required.

(21) Here $I=64{,}35$, $P=260$, and $t=5{,}5$.

Then per Theo. $\frac{64{,}35}{200\times5{,}5}=\frac{64{,}35}{1430}={,}045$, or $4\frac{1}{2}$ per Ct. the Anſwer.

(22) Here $I=235{,}4\dot{6}$, $P=560{,}63541\dot{6}$, and $t=7$.

Then per Theo. $\frac{235{,}4\dot{6}}{560{,}63541\dot{6}\times7}=\frac{235{,}46666666}{3924{,}44791\dot{6}}={,}06$, or 6 per Cent. the Anſwer.

Theorem VIII. $\frac{a-P}{Pt}=r$ the Rate.

(23) Here $a=354{,}2208\dot{3}$, $P=284{,}5$ and $t=7$.

Then per Theo. $\frac{354{,}2208\dot{3}-284{,}5}{284{,}5\times7}=\frac{69{,}7208\dot{3}}{1991{,}5}={,}035$, or $3\frac{1}{2}$ per Cent. the Anſwer.

(24) Here $a=500{,}463541\dot{6}$, $P=378{,}9$, and $t=6$.

Then per Theo. $\frac{500{,}463541\dot{6}-378{,}9}{378{,}9\times6}=\frac{121{,}563541\dot{6}}{2273{,}4}$ $={,}053472+$, or 5£. 6*s.* $11\frac{1}{4}$*d.* ,312, per Cent. the Anſw.

(25) Here $a=847{,}875$, $P=672{,}25$, and $t=5{,}5$.

Then per Theo. $\frac{847{,}875-672{,}25}{672{,}25\times5{,}5}=\frac{175{,}62500}{3697{,}375}={,}0475$. or $4\frac{3}{4}$ per Cent. the Anſwer.

60. OF ANNUITIES, PENSIONS, &c. IN ARREARS, AT SIMPLE INTEREST.

Theorem 9. $\frac{ttu-tu}{2}\times r:+tu=A$, the Amount.

(26) Here $u=250$, $t=6$, and $r={,}03$.

Then per Theo. $\frac{250\times6\times6-250\times6}{2}\times{,}03:+250\times6=$ $\frac{9000-1500}{2}\times{,}03:+1500=3750\times{,}03=1125,$ $+1500=1612{,}5$, or 1612£. 10*s.* the Anſwer.

(27) Here $u=125$, $t=12$, and $r={,}015$, per Note.

Then per Theo. $\frac{125 \times 12 \times 12 - 125 \times 12}{2} \times ,015 : + 125 \times 12 = \frac{18000 - 1500}{2} \times ,015 : + 1500 = \overline{8250 \times ,015 + 1500} = 123,75 + 1500 = 1623,75 =$ 1623£. 15s. the Anſ.

(28) Here $a = 62,5$, $t = 24$, and $r = ,0075$. per Note.

Then per Theo. $\frac{62,5 \times 24 \times 24 - 62,5 \times 24}{2} \times ,0075 : + 62,5 \times 24 = \frac{36000 - 150}{2} \times ,0075 : + 1500 = \overline{17250 \times ,0075 + 1500} = 129,375 + 1500 = 1629,375 =$ 1629£. 7s. 6d. the Anſwer.

Theorem X. $\frac{2a}{ttr - tr + 2t} =$ U, the Annuity.

(29) Here $a = 1612,5$, $t = 6$, and $r = ,03$.

Then per Theo. $\frac{1612,5 \times 2}{6 \times 6 \times ,03 - 6 \times ,03 \times 2} = \frac{3225,0}{2,9} =$ 250£. the Anſwer.

Theo. for half yearly Payment. $\frac{4a}{ttr - tr + 2t} =$ U.

(30) Here $a = 1623,75$, $t = 12$, and $r = ,015$.

Then per Theo $\frac{1623,72 \times 4}{12 \times 12 \times ,015 - 12 \times ,05 + 12 \times 2} = \frac{6495}{1,98 + 24} = \frac{6495,00}{25,98} =$ 250£. the Anſwer.

Theo. for quarterly Payment. $\frac{8a}{ttr - tr + 2t} =$ U.

(31) Here $a = 1629,375$, $t = 24$, and $r = ,0075$.

Then per Theo. $\frac{1629,375 \times 8}{24 \times 24 \times ,0075 - 24 \times ,0075 + 24 \times 2} = \frac{13035}{4,14 \times 48} = \frac{13035,00}{52,14} =$ 250£. the Anſwer.

Theo. XI. $\frac{2a-2ut}{utt-ut}=r$, the Rate

(32) Here $a=1612,5$, $u=250$, and $t=6$.

Then per The. $\frac{1612,\ \times2-250\times2\times6}{250\times6\times6-250\times6}=\frac{3225-3000}{9000-1500}=$ $\frac{225.00}{7500}=,03$, or 3 per Cent. the Anſwer.

Theo. for half yearly Payments, $\frac{4a-4ut}{utt-ut}=r$.

(33) Here $a=1623,75$, $u=125$, and $t=12$, per Note.

Then per Theo. $\frac{1623.75\times4-125\times4\times12}{125\times12\times12-125\times12}=\frac{6495-6000}{18000-1500}$ $=\frac{405.00}{16500}=,03$, or 3 per Cent. the Anſwer.

Theo. for quarterly Payments. $\frac{8a-8ut}{utt-ut}=r$

(34) Here $a=1629,375$, $u=62,5$, and $t=24$.

Then per Theo. $\frac{1629.375\times8-62,5\times8\times24}{62,5\times24\times24\times-62,5\times24}=$ $\frac{13035-12000}{36000-1500}=\frac{1035,00}{34500}=,03$, or 3 per Cent. Anſw.

Theorem XII. Firſt $\frac{2}{r}-1=X$. Then $\sqrt{\frac{2a}{ur}+\frac{xx}{4}}:-\frac{x}{2}=T$.

(35) Here a 1$=1612,5$, $u=250$, and $r=,03$.

Then per Theorem I. $\frac{2}{,03}-1=65,6=X$.

Then $\sqrt{\frac{1612,5\times2}{250\times,03}+\frac{65,6\times65,6}{4}}:-\frac{65,6}{2}=$ $\sqrt{\frac{3225}{7,5}+\frac{4,307\cdot73}{4}}:-32,8=\sqrt{1506,93}-32,8=38,8$ $-32,8=6$ Years, the Anſwer.

(36) Here $a=1623,75$, $u=125$, and $r=,015$.

Then per Theorem I. $\frac{2}{,015}-1=132,3=X$.

Then $\sqrt{\frac{1623,75\times 2}{125\times ,015}+\frac{132,8\times 132,8}{4}} : -\frac{132,8}{2} =$
$\sqrt{\frac{3247,5}{1,875}+\frac{17507,68}{4}} : -66, = \sqrt{1752+4370,92}$
$: -66,1 = \sqrt{6108,92}-66,1 = 78,1-66,1 = 12$
Half yrs. or 6 yrs. the Time required.

(37) Here $a=1629,375$, $u=62,5$, and $r=,0075$.
Then per Theorem I. $\frac{2}{,007}-1=265,6=X$.

Then $\sqrt{\frac{1629,375\times 2}{62,5\times ,0075}+\frac{265,6\times 265,6}{4}} : -\frac{265,6}{2} =$
$\sqrt{\frac{3258,75}{,46875}+\frac{70761,06}{4}} : -132,8 = \sqrt{6952+17690,26}$
$-132,8 = \sqrt{24642\ 26}-132,8 = 1569,-132,8 = 24$
Quarterly Payments, or 6 Years, the Anſwer.

61. PRESENT WORTH OF ANNUITIES, &c.

Theorem XIII. $\frac{\overline{ttr-tr+2t}}{2tr+2} : \times u = P$. The preſent Worth

(38) Here $t=6$, $r=,03$, and $u=250$.
Then per Theo. $\frac{6\times 6\times ,03-6\times 03+6\times 2}{2\times 6\times ,03+2} : \times 250 =$
$\frac{1,08-,18+12}{,36+2}\times 250 = \frac{12,9}{2,36}\times 250 = 5,4661017\times$
$250 = 1366,52675$, or 1366£. 10*s.* 6*d.* ,42, the preſenth Worth required.

(39) Here $t=12$, $r=,015$, and $u=125$.
Then per Theo. $\frac{12\times 12\times ,015-,1+,015+12\times 2}{12\times 2\times ,015+2} : \times 125$
$= \frac{2,06-,18+24}{,36+2} : \times 125 = \frac{1,98+24}{2,36} : \times 125 \times$
$\frac{25,98}{2,36}\times 12 = 11,008474\times 125 = 1376,05925 = 1376$£. 1*s.* 2*d.* ,22 the preſent Worth.

(40) Here is given $t=24$, $u=62{,}5$, and $r={,}0075$.

Then per Theo. $\frac{24\times24\times{,}0075-24\times{,}0075+24\times2}{24\times2\times{,}0075+2}:\times$

$6{,}25=\frac{4{,}32-{,}18+48}{2{,}36}:\times 62{,}5=\frac{4{,}14+48}{2{,}36}:\times 62{,}5$

$=\frac{52{,}14}{2{,}36}:\times 62{,}5 = 22{,}09322\times 62{,}5=1380{,}82625=$ 1380£. 16*s.* 6*d.* ,3, the Anſwer.

Theorem XIV. $\frac{tr+1}{ttr-tr+2t}:\times 2p=$ U, the Annuity.

(41) Here is given $t=6$, $r={,}03$, and $p=1366{,}525$. To find U.

Then per Theo. $\frac{6\times{,}03+1}{6\times6\times{,}03-6\times{,}03+6\times2}:\times 1366{,}525\times2$

$=\frac{1{,}18}{12{,}9}\times 2733{,}05={,}0914728\times 2733{,}05=$ 250£. the Annuity required.

(42) Here is given $t=12$, $r={,}015$, and $p=1376{,}25$. To find U.

Then per Theo. $\frac{12\times{,}015+1}{12\times12\times{,}015-12\times{,}015+12\times2}:\times$

$1376{,}25\times4=\frac{1{,}18}{25{,}98}\times5505={,}0454195\times5505=$ 250£. 8½*d.* the Annuity required.

(43) Here is given $t=24$, $r={,}0075$, and $p=1380{,}875$. To find U.

Then per Theo. $\frac{24\times{,}0074+1}{24\times24\times{,}0075\times12\times{,}0075+24\times2}\times$

$1380{,}875\times8=\frac{1{,}18}{52{,}14}\times 11047={,}022631\times11047=$ 250£. the Anſwer.

Theorem XV. $\frac{\overline{ut-p}\times2}{2pt+ut-utt}=$ R, the Rate.

(44) Here is given, $u=250$, $t=6$, and $p=1366{,}525$. To find R.

Then per Theo. $\frac{\overline{250\times6-1366{,}525\times2}}{\overline{1366{,}525\times2\times6}+\overline{250\times6-250\times6\times6}}$

$=\frac{133{,}475\times2}{17898{,}3-900}=\frac{266{,}95}{8898{,}3}=,03=3$ per Cent. the Anſ.

(45) Here is given $u=125$, $t=12$, and $p=1376{,}25$. To find R.

Then per Theo. $\frac{\overline{125\times12-1376{,}25\times2}}{1376{,}25\times2\times12+125\times12-125\times12\times12}$

$=\frac{\overline{1500-1376{,}25}\times2}{33030+1500-18000}=\frac{123{,}75\times2}{34520-18000}=\frac{2475}{165000}$ $=,015$ half the Rate, which $\times2=,03$ or 3 per Cent. the Anſwer.

(46) Here is given $u=62{,}5$, $t=24$, and $p=1380{,}875$. Then per Theorem.

$$\frac{\overline{62{,}5\times24-1380{,}875\times2}}{\overline{1380{,}875\times2\times24}+\overline{62{,}5\times24}-\overline{62{,}5\times24\times24}}=$$

$\frac{288{,}25}{31782}=,0075$, which $\times\ 4=,03$ or 3 per Cent. the Anſwer.

Theo. XVI. $\frac{2}{r}\ \frac{2p}{u}-1=X$. Then $\sqrt{\frac{2p}{ur}+\frac{xx}{4}}-\frac{x}{2}=t$ the Time.

(47) Here is given $u=,\ 250.\ p=1366{,}525$, and $r=,03$.

Then per Theo. firſt $\frac{2}{,03}\ \frac{\overline{1366{,}525\times2}}{250}-1=66{,}6-$ $=11{,}9322=54{,}73446=X$.

Then $\sqrt{\frac{1366{,}525\times2}{250\times,03}+\frac{54{,}723446\times54{,}73446}{4}}$

$\frac{54{,}73446}{2}=\sqrt{\frac{2733{,}05}{7{,}5}+\frac{2005080}{4}}-27{,}8=\sqrt{1113{,}36}=$ $27{,}3=33{,}3-27{,}8=6$ Years, the Anſwer.

(48)

(48) Here is given $u=125$, $p=1376{,}25$, and $r={,}015$.

Then per Theo. firſt $\frac{2}{{,}015}-\frac{1376{,}25\times 2}{125}-1=133{,}3-$ $23{,}02=110{,}313=X$.

Then $\sqrt{\frac{1376{,}25\times 2}{125\times{,}015}+\frac{110{,}313\times 110{,}313}{4}}-\frac{110{,}313}{2}=$ $\sqrt{4510{,}2486}-55{,}15=67{,}15-55{,}15=12$ half yearly Payments, or 6 Years the Time required.

(49) Here is given $u=62{,}5$, $p=1380{,}875$, and $r={,}0075$.

Then per Theo. firſt $\frac{2}{{,}0075}-\frac{1380{,}875\times 2}{62{,}5}-1=266{,}6-$ $45{,}188=221{,}4786=X$.

Then $\sqrt{\frac{1380{,}875\times 2}{62{,}5\times{,}0075}+\frac{221{,}4786\times 221{,}4786}{4}}-$ $\frac{221{,}4786}{2}=\sqrt{5891{,}733+12263{,}1961}-110{,}7393=$ $\sqrt{18154{,}92}-110{,}7=134{,}7-110{,}7=24$ quarterly Payments, or 6 Years, the Time required.

62. ANNUITIES, &c. TAKEN IN REVERSION.

Theo. XVII. $\frac{ttr-tr+2t}{2tr+2}:\times u=p$, which change to a,

Then $\frac{a}{tr+1}=p$, the preſent Worth.

(50) Here firſt $U=250$, $t=6$, and $R={,}03$, then per Theo. I.

$\frac{ttr-tr+2t}{2tr+2}:\times U=\frac{6\times\overline{6{,}03}\quad 6\times{,}03+6\times 2}{\overline{6\times{,}03\times 2}+2}:\times 250=$ $\frac{1{,}08-{,}18+12}{{,}36+2}\times 250=\frac{{,}9+12}{2{,}36}\times 250=\frac{12{,}9}{2{,}36}:\times 250=$ $5{,}4661016\times 250=1366{,}5254=P$.

Now per Rule 2. $A=1366{,}5254$, $t=4$, and $r={,}03$.

Then per Theo. II. $\frac{a}{tr+1}=\frac{1366,5254}{4\times,03+1}=\frac{1366,5254}{1,12}=$ 1220,112, or 1220*l.* 2*s.* $3\frac{1}{4}$*d.* the preſent Worth required.

(51) Here is given, firſt $r=,045$, $t=7,5$, and $u=80$.

Then per Theo. I. $\frac{7,5\times7,5\times,045-7,5\times,045+7,5\times2}{7,5\times2\times,045+2}$

$:\times80=\overline{2,53125-,3375+15}\times80\,\frac{17,10375}{2,675}\times80=$

$64,2756\times80=514,2048\times p.$

Now per Theo. II. $p=a$, and r, as before $=,5$.

Then $\frac{514,2048}{5\times,045+1}=\frac{514,2046}{1,225}=419,95759=419$£. 19*s.* $1\frac{3}{4}$*d*, the Anſwer.

(52) Here is given $a=40$, $t=10$, and $r=,05$.

Then per Theo. I. $\frac{10\times10\times,05-10\times,05+10\times2}{10\times2\times,03+2}\times40$

$=\frac{4,5+20}{1+2}\times40=\frac{24,5}{3}\times40=80,1\dot{6}\times40=326,\dot{6}=p.$

Now per Theo. II. $a=326,\dot{6}$, and $t=7$.

Then $\frac{326,6}{7\times,05+1}=\frac{326,\dot{6}}{1,35}=241,9755=241$£. 19*s.* 6*d.* ,12, the preſent Worth.

Theorem XVIII. $ptr+p=A$, the Amount. Change A, and call it p, and t here will $=$ the Time of its Continuance.

Then $\frac{tr+1}{ttr-tr+2t}:\times2p=U$, the Annuity, &c.

(53) Here is given $p=1220,11458\dot{3}$, $t=4$, and $r=,03$.

Then per Theorem I. $\overline{1222,111458\dot{3}\times4\times,03}+$ $1220,111458\dot{3}=146,413375+1220,111458\dot{3}=$ $1366,52483=A.$

Now, A. changed, it becomes p, and $t=6$.

Then per Theo. II. $\dfrac{\overline{6\times,03+1}}{\overline{6\times 6\times,03-6\times,03+6\times 2}}\times$ $1366,52483\times 2=\dfrac{1,18}{12,9}\times 2733,049666=2723,049666$ $\times,0914728=250$£. the Annuity.

(54) Here is given $p=419,755208$, $t=5$, and $r=,045$.
Then per Theorem I. $\overline{419,755208\times 5\times,045}+419,755208$ $=94,4449218+419,755208=514,2001298=A$.
Now A changed becomes p, and t here $=7,5$.

Then per Theo. II. $\dfrac{\overline{7,5\times,04+1}}{\overline{7,5\times 7,5\times,045-7,5\times,045+7,5\times 2}}$ $\times 514,2001298\times 2=\dfrac{1,3375}{17,19875}\times 1028,4002596=$ $,077789\times 1028,4002596=80$£. the Anſwer.

(55) Here is given $p=241,975308$, $t=7$, and $r=,05$.
Then per Theorem I. $\overline{241,975308\times 7,05}+241,975308$ $=326,6666658=A$.
Now, A. changed becomes $p=326,6666658$, and $t=10$.

Then per Theo. II. $\dfrac{\overline{10\times,05+1}}{\overline{10\times 10\times,05-10\times,05+10\times 2}}$ $\times 326,6666658\times 2=\dfrac{1,5}{24,5}\times 653,3333316=$ $653,3333316\times,06122448=80$£. nearly the Anſwer.

63. REBATE or DISCOUNT.

Theorem XIX. $\dfrac{s}{\overline{tr+1}}=P$, the preſent Worth.

(56) Here $s=150$, $t=,75$, and $R=,05$; then per Theorem $=\dfrac{s}{\overline{tr+1}}=\dfrac{150}{\overline{,75\times,05}+1}=\dfrac{150}{1,0375}=144,5784+$ or 144*l*. 11*s*. 6¾*d*. the preſent Worth required.

(57) Here is given $s=1000$ $t=5$mo.$=,116$yr. and $r=,045$.

Then per Theo. $\dfrac{1000}{\overline{,4\ 6\times,045}+1}=\dfrac{1000}{1,01875}=981,595=$ 981£. 11*s*. 10¼*d*. the preſent Worth required.

(58)

(58) Here is given $s=9342$, $r=,04$, and $t=10$ mo. $=,8\dot{3}$ yr.

Then per Theo. $\frac{9342}{,8\dot{3}\times,04+1}=\frac{9342}{1,0\dot{3}}=9038,9$ the preſent Worth.

And $9342-9038,9=303,1=303$£. 2*s.* the Diſcount.

Theorem XX. P. $tr+p=S$, the Sum due.

(59) Here is given $p=144,578125$, $t=,75$, and $r=,05$.
Then per Theo. $144,578125\times,75\times,05+144,578125=5,421679+144,578125=149,9998$, or rather 150£. the Anſwer.

(60) Here is given $p=981,52085$, $t=,41\dot{6}$, and $r=,045$.
Then per Theorem, $981,5208\dot{3}\times,41\dot{6}\times,045+981,52=18,403518+981,5208\dot{3}=999,9243485=999$£. 18*s.* 5¼*d.* the Sum due.

(61) Here is given $p=9111,18514\dot{6}$, $t=,8\dot{3}$, and $r=,045$.
Then per Theo. $9111,185416\times,8\dot{3}\times,04+9111,185416=303,70618+9111,185146=9414,891326=9414$£. 17*s.* 9¼*d.* 6, the Debt.

Therorem XXI. $\frac{s-p}{pr}=T$, the Time.

(62) Here is given $s=150$, $p=144,578125$, and $r=,05$.

Then per Theo. $\frac{150-144,578125}{144,578125\times,05}=\frac{5,42187500}{7,22890625}=,75$ yr. or 9 Months, the Time required.

(63) Here is given $s=1000$, $p=981,5208\dot{3}$, and $r=,045$.

Then per Theo. $\frac{1000-981,5208\dot{3},}{981,5208\dot{3}\times,045}=\frac{18,4791\dot{6}}{44,16845749}=$ $,41\dot{6}$, or 5 Months, the Anſwer.

(64) Here is given $s=9342$, $p=9111,185416$, and $r=,04$

Then per Theo. $\frac{9342-9111,185416}{9111,185416\times,04}=\frac{230,814584}{364,447416}=$ $,63332=7$ mo. 18 Days, the Anſwer.

Theorem XXII. $\frac{s-p}{pt}=R$, the Rate.

(65) Here is given $s=150$, $p=144,578125$, and $t=,75$

Then per Theo. $\frac{150-144{.}578125}{144{,}578125\times{,}75}=\frac{5{,}421875}{108{,}43359375}=$,05 or 5 per Cent. the Rate required.

(66) Here is given $s=1000$, $p=981{,}52083$, and $t={,}416$.

Then per Theo. $\frac{1000-981{.}52085}{981{,}52083\times{,}416}=\frac{18{,}47016}{40{,}89570138}=$,045 or $4\frac{1}{2}$ per Cent. the Anſwer.

(67) Here is given $s=9342$, $p=9111{,}185416$, and $t={,}83$.

Then per Theo. $\frac{9842-9111{,}185416}{9111{,}185416\times{,}83}=\frac{230{,}814584}{769{,}26989582}=$,03 or 3 per Cent. the Anſwer.

64. EQUATION OF PAYMENTS.

Theorem XXIII. $\frac{s}{tr+1}=$ P, the preſent Worth.

(68) Here is given $r={,}035$, the firſt $t={,}5$, the ſecond, and the third $={,}83$.

Then per Theo. the preſent Worth will be as follows, viz.

	£.
Paid down	400
$\frac{500}{{,}5\times{,}035+1}=\frac{500}{1{,}075}=491{,}40049$	
2. $\frac{250}{{,}6\times{,}035+}=\frac{250}{1{,}0213}=244{,}78605$	
3. $\frac{250}{83\times{,}035+1}=\frac{250}{1{,}025}=243{,}002439$	

the Sum $=1380{,}089179=p$.

$1400\qquad\qquad=s$.

$s-p=$ Diff. $19{,}910821=d$.

Now per Theo. II. $\frac{d}{pr}=\frac{19{,}910821}{1380{,}8179\times{,}035}=\frac{19{,}910821}{48{,}303121265}$ $={,}41013$ or 5 Months nearly, the true equatic Time required.

(69) As 12,3£. : 47 Days :: 949,5£. : 18,45 Days, the Anſwer.

(70) Here is given $a=542,4$, $p=384$, and $t=8,25$.

Then per Theo. VIII. $\frac{a-p}{pt}=\frac{542,4-384}{384\times 8,25}=\frac{185,4}{3168}=$,05, or 5 per Cent. the Anſwer.

65. COMPOUND INTEREST.

Theorem I. $prt=A$. the Amount.

(1) Here is given $p=246,5$, $t=7$, and $r=1,05$.

Then per Theorem.

$246,5\times 1,05\times 1,05\times 1,05\times 1,05\times 1,05\times 1,05\times 1,05=$ $246,5\times 1,4071004=346,8502486=346$£. 17*s.* the Amount required.

By Table I. thus,

Again 7 yrs. under 5 per Cent. is	1,4071004
Which multiplied by the Principal	246,5

Gives the Amount as before, viz. 346,8502486=346£. 17*s.*

(2) Here is given $p=500$, $t=30$, and $r=1,045$, which raiſed to the 30th Power, will give $3,7453181=rt$. (See Table I.)

Then $3,7453181\times 500=1772,65905=1772$£. 13*s.* 2*d.* ,172, the Amount for 30 Years.

Again, ſuppoſe the Amount was required only for 30*d.*

Then $r=1,0001206$, which raiſed to the 30th Power, $=1,0036243$. (See Table II.) the Amount of 1£. for 30 Days.

∴ $1,0036243\times 500=501,81215=501$£. 16*s.* 3*d.* ,156, the Amount.

(3) Here is given $p=523$, $t=5$ yrs. 194*d.* and $r=1,05$.

Now the Amount of 1£. for 5 yrs. is $1,05\times 1,05\times 1,05\times 1,05\times 1,05=1,2762816$. (See Table I.)

Then, per Table II. the Amount of 1£. for 100*ds.* $=1,0134569$; for $90=1,0121031$; and for $4=1,0005348$

∴ $1,2762816\times 1,0135345 69\times 1,012031\times 1,0005 48=$ 1,31097607, the Amount of 1£. for 5 yrs. 194*d.*

Now $1,31097072\times 423=685,64048565 6\times 685$£. 1,310976072, the Amount of 1£. for 5 yrs. 194*d.*

Therefore $1,310976072\times 523=685,64048565 6=685$£. 12*s.* 9½*d.* ,8, the Anſwer.

Theorem II. $\frac{a}{rt}=$

(4) Here is given $a=243,10126$, $t=4$, and $r=1,05$.

Then per Theo. $\frac{243,10126}{1,05\times1,05\times1,05\times1,05}=\frac{243,10126}{1,2155063}$ $=200$£. the Anſwer.

(5) Here is given $a=346,85$ $t=7$, and $r=1,05$.
Then per Theorem,

$$\frac{346,85}{1,05\times1,05\times1,05\times1,05\times1,05\times1,05\times1,05}=\frac{346,85}{1,4071004}$$

$=246,5=246$£. 10*s*. the Anſwer.

(6) Here is given $a=1872,65905$, $t=30$, and $r=1,045$, which raiſed to 30th Power $=3,7453181$. (See Table I.)

Then per Theo. $\frac{1872,65905}{3,7453181}=500$£. the Anſwer.

(7) Here is given $a=685,64$, $t=5$ yrs. 194*d*. and $r=1,05$, which raiſed to the Power of $t=1,310976$.

Then per Theo. $\frac{685,64}{1,310976}=523$£. the Anſwer.

Theorem III. $\frac{a}{p}=Rt$.

(8) Here is given $a=346,85$, $p=246,5$, and $r=1,05$.

Then per Theo. $\frac{346,85}{246,5}=1,4071004=Rt$.

Which $\div 1,05$ till nothing remains, and the Number of Diviſions will be 7, or 7 yrs. the Anſwer.

(9) Here is given $a=1872,65905$, $p=500$, and $r=1,045$.

Then per Theo. $\frac{1872,65905}{500}=3,7453181=Rt$.

Which Number look for in Table I. under $4\frac{1}{2}$ per Cent. and you will find it to be even with 30 yrs. the Anſw.

(10) Here is given $a=685,64$, $p=523$, and $r=1,05$.

Then per Theo. $\frac{685{,}64}{523} = 1{,}310976 = Rt.$ the neareſt Number (leſs) to which under 5 per Cent, is even with 5 yrs. viz. 1,2762816.

Then 1,310976 ÷ 1,2762816 = 1,027184025 the neareſt Number to which, in Table II. is even with 100 Days, viz. 1,0134569.

Therefore 1,027184025 ÷ 1,0134569 = 1,01264437 the neareſt Number (leſs) to which in Table II. is even with 90 ds. viz 1,0121031.

So 1,01264437 ÷ 1,0121031 = 1,0005343, which is even with 4 Days, in Table II.

Therefore the Anſwer is 5 yrs. 194 d.

Theorem IV. $\frac{a}{p} = Rt.$

(11) Here is given $a = 346{,}85$, $p = 246{,}5$, and $t = 7$.

Then per Theo. $\frac{346{,}85}{246{,}5} = 1{,}4071004 = r,$ raiſed to the 7th Power.

Then per Rule in Page 238 $r^7 = \sqrt{1{,}4071004} = 1{,}05$ or 5 per Cent. the Anſwer.

(12) Here is given $a = 1872{,}65905$, $p = 500$, and $t = 30$.

Then per Theo. $\frac{1872{,}65905}{500} = 3{,}7453181 = rt.$ which Number look for in Table I. and even with 30 yrs. you will find it to be under 4½ per Cent. the Anſwer.

(13) Here is given $a = 685{,}64$ $p = 523$, and $t = 5$ yrs. 194d.

Then per Theo. $\frac{685{,}64}{523} = 1{,}310976 = rt.$ Now the neareſt Number to which, even with 5 yrs. is under 5 per Cent. the Anſwer.

66. ANNUITIES, PENSIONS IN ARREARS.

Theorem V. $\frac{Ur^t - u}{r-1} = A$, the Amount.

(14) Here is given, $u=70$, $t=4$, and $r=1,04$.

Then per Theo. $\frac{Ur^t-u}{r-1} = 70\times\frac{1,04\times1,04\times1,04\times1,04-70}{1,04-1}$

$= \frac{70\times1,698586-70}{,04} = \frac{11,8012}{,04} = 297,25255$ or 297£. 5s. 0½d. the Amount.

By Table III. thus,

Againſt 4 yrs. and under 4 per Cent. is 4,246464

Which multiplied by the Annuity 70

Gives the preſent Worth as before, viz. 297,25248

(15) Here is given $u=100$, $t=6$, and $r=1,05$.

Then per Theorem

$$\frac{100\times1,05\times1,05\times1,05\times1,05\times1,05\times1,05-100}{1,05-1} =$$

$$= \frac{100\times1,3400956-100}{,05} = \frac{134,00956-100}{,05} = \frac{34,00956}{,05}$$

$=680,192=$ 680£. 3s. 9¼d. the Amount.

(16) Here is given $u=70$, $t=7$, and $r=1,03$; which raiſed to the 7th Power$=1,2298733$. (See Table I.)

Then per Theo. $\frac{70\times1,2298733-70}{1,03-1} = \frac{86,091131-70}{,03} =$

$= \frac{16,091131}{,03} = 536,37103 =$ 536£. 7s. 5d. the Anſwer.

(17) Here is given $u=30$, $t=30$, and $r=1,035$; which raiſed to the 30th Power$=2,8067937$ per Table I.

Then per Theo. $\frac{30\times2,8067937-30}{1,035-1} = \frac{84,20381-30}{0,35} =$

$\frac{54,20381}{,035} = 1548,680257 =$ 1548£. 13s. 7¼d. the Amount required.

Theorem VI. $\frac{ar-a}{r^t-1}$ = U, the Annuity, &c.

(18) Here is given a=680,1912, t=6, and r=1,05. ; which raiſed to the 6th Power=1,3400956.

Then per Theo. $\frac{680,1912 \times 1,05 - 680,1912}{1,3400956 - 1} = \frac{34,00965}{,3400956}$ =100£. the Anſwer.

(19) Here is given a=536,37103 (per Queſt. 3.) t = 7, and r=1,03 ; which raiſed to the ſeventh Power = 1,2298733.

Then per Theo. $\frac{536.37103 \times 1,03 - 536.37103}{1,2298733 - 1}$ = $\frac{552.46219 - 536,37103}{,2298733} = \frac{16.0011632}{,2298733}$ = 70 £. the Anſwer.

(20) Here a=1548,680257, t=30, and r=1,035 ; which raiſed to the 30th Power=2,8067937 per Table I.

Then per Theo. $\frac{1548,680257 \times 1,037 - 1548,680257}{2,8067937 - 1}$ = $\frac{1602,884066 - 1548,680257}{1,8067937} = \frac{54.203819}{1,8067937}$ = 30£. the Anſwer.

Theorem VII. $\frac{ar+u-a}{u}$ = Rt.

(21) Here a=680,1912, u=100, and r=1,05.

Then per Theo. $\frac{680,1012 \times 1,05 + 100 - 680,1912}{100}$ = $\frac{814,20076 - 680,1912}{100} = \frac{340,0956}{100}$ = 3,400956 = Rt, which proceed with as directed in Example 8, will give 7 yrs. the Anſwer.

(22) Here $a=536,37103$, $u=70$, and $r=1,03$.

Then per Theo. $\frac{536,37103 \times 1,03 + 70 - 536,37103}{70} =$

$\frac{622,46219 - 536,37103}{70} = \frac{86,09113}{70} = 1,2298733 =$ R*t*. which proceed with as before directed, will give 7 yrs. the Anſwer.

(23) Here $a=1548,680257$, $u=30$, and $r=1,035$.

Then per Theo. $\frac{1548,68025 \times 035 + 30 - 1548,680257}{30}$

$= \frac{1632,884066 - 1548,680257}{30} = \frac{84,203809}{30} =$

$2,8067936 =$ R*t*. which Number look for under $3\frac{1}{2}$ per Cent. and you will find it to be even with 30 yrs. the Anſwer. (See Table I.)

Theorem VIII. $\frac{ar}{n} - r^t = \frac{a-u}{u} = R^t$.

(24) Here $a=680,1912$, $u=100$, and $t=6$.

Then per Table $680,1912 \div 100 = 6,801912 = r^t$; even with 6 yrs. you will find it to be under 5 per Cent.

(25) Here $a=536,37103$, $u=70$, and $t=7$.

Then $536,37103 \div 70 = 7,662729 =$ R*t*. then in Table III. even with 7 yrs. you will find it to be under 3 per Cent. the Anſwer.

(26) Here $a=1548,680257$, $u=30$, and $t=30$.

Then $1548,680257 \div 30 = 51,6226752 =$ R*t*. which even with 30 yrs. you will find it to be under $3\frac{1}{2}$ per Cent. the Anſwer.

67. PRESENT WORTH OF ANNUITIES.

Theo. IX. $u - \frac{u}{r^t}; \div r - 1 = P$, the preſent Worth.

(27) Here $U=50$, $t=8$, and $r=1,05$, which being involved to $R^t=1,4774554$ by the 1ſt Table.

Then per Theo. $U — \frac{u}{r^t} \div r — 1 = 50 — \frac{50}{1,477454} \div 1,05 — 1 = 50 — 33,84196 \div ,05 = 16,15804 \div ,05 = 323,1608$, or 323£. 3s. 2½d.

By Table V. thus,

Againſt 8 yrs. and under 5 per Cent. is	6,4632128
Which multiplied by the Annuity, viz.	50
Gives the preſent Worth, viz.	323,16064

(28) Here is given $u = 60$, $t = 6$, and $r = 1,04$. Which being involved to the 6th Power $= 1,265319$, per Table I.

Then per Theo. $60 — \frac{60}{1,265319} \div 1,04 — 1 = \frac{60 — 47,41096}{,04} = \frac{12,58904}{,04} = 314,726 = 314$£. 14s. 6¼d. the Anſwer.

(29) Here $u = 1000$, $t = 21$, and $r = 1,045$. Which being involved to the 21ſt Power $= 2,5202411$, per Table I.

Then per Theorem $1000 — \frac{1000}{2,5202411} \div 1,045 — 1 = \frac{1000 — 396,787434}{,045} = \frac{603,2125657}{,045} = 1340472386 =$ 13404£. 14s. 5¾d. the Anſwer.

Theorem X. $\frac{\overline{pr^t \times r — pr^t}}{r^t — 1} = U$, the Annuity.

(30) Here is given $p = 323,1608$, $t = 8$, and $r = 1,05$; which being involved to the 8th Power $= 1,4774554$, per Table I.

Then per Theorem,

$$\frac{323,1608 \times 1,4774554 \times 1,05 — 323,1608 \times 1,4774554}{1,4774554 — 1} = \frac{501,3380 — 477,4567}{,4774554} = 50\text{£. the Annuity.}$$

(31)

(31) Here $p=314,726$, $t=6$, and $r=1,04$; which being involved to the 6th Power$=1,265319$.

Then per Theorem,

$$=\frac{314,726\times1,265319\times1,04-314,726\times1,265310}{1,265319-1}=$$

$$=\frac{414,157939-398,228785}{,265319}=\frac{15,928155}{,265319}=60£.$$ the Annuity required.

(32) Here $p=13404,72386$, $t=21$, and $r=1,045$; which being involved to the 21ſt Power $=2,5202411$, per Table I.

Then per Theorem,

$$\frac{13404,72386\times2,5202411\times1,045-13401,7236\times2,5202411}{2,5202411-1}=\frac{353,0337712-337,83136}{1,5202411}=\frac{1520,2411}{1,5202411}$$

$=1000£$. the Annuity.

Theo. XI. $\frac{u}{p+u-pr}=R^t$.

(33) Here is given $u=50$, $p=323,1608$, and $r=1,05$.

Then per Theorem, $\frac{50}{323,1608+50-323,1608\times1,05}$

$=\frac{50}{33,84196}=1,4774554=R^t$, which proceed with as in Example 8, and the Number of thoſe Diviſions will be 8, that is, 8 yrs. the Anſwer.

(34) Here $u=60$, $p=314,726$, and $r=1,04$.

Then per Theorem, $\frac{60}{314,726+60-314,726\times1,04}$

$\frac{60}{374,726-327,315}=\frac{60}{47,411}=1,265319=R^t$ which proceed with, as in the laſt Example, and the Number of Diviſions will be 6, which is 6 yrs. the Anſwer.

(35) Here $u=1000$, $p=13404{,}72386$, and $r=1{,}045$. Then per Theorem,

$$\frac{1000}{\overline{\overline{13404{,}72386+1000-13404{,}72386,\times 1{,}045.}}}=\frac{1000}{14404{.}72386-14007{,}936433}=\frac{1000}{396{,}787426}=$$

$2{,}5202411=$ R*t*. which in Table I. under 4½ per Cent. is even with 21 Years, the Anſwer.

Theorem XII. $\frac{u}{p}=\frac{u}{p}$ R*t*. + R*t*. — R*t*. + 1

To perform the three following Examples by the Theorem, ſee the Appendix.

(36) Here is given $u=50$, $p=323{,}1608$, and $t=8$. Then by the fith Table thus,
Firſt $323{,}1608\div 50=6{,}463216$. Then even with 8 yrs. you will find it under 5 per Cent. the Anſwer.

(37) Here $u=60$, $p=314{.}726$, and $t=6$
Then $314{.}726\div 60=5{,}24548$, which Number look for in Table V. even with the given Time, and the neareſt Number is under 4 per Cent. the Anſwer.

(38) Here $u=1000$, $p=13404{,}72386$.
Then $13404{,}72386\div 1000=13{,}40472386$, which Number even with the given Time, you will find under 4½ per Cent the Anſwer.

68. ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

Theorem I. $u-\frac{u}{r}:\div r-1=p$, which change to A.

Then $\mathrm{A}-\frac{\mathrm{A}}{\mathrm{R}t.}=p$.

(39) 1. Here $u=80$, $t=6$, and $r=1{,}05$, then per Rule 1.

$$u-\frac{u}{rt}\div r-1=80-\frac{80}{1{,}3400955}\div 1{,}05-1=80-$$

59,

$59,6976 \div ,05 = 20,3028 \div ,05 = 406,056 = P$. Then per Rule 2. $A = 406,056$, $t = 2$, and r, as before, and per Theorem 2, $\frac{a}{rt} = \frac{406,056}{41,1025} = 368,30419$, or 368 £. 6s. 1d. the preſent Worth required.

Thus, by Table V. 2+6=8 Years.

$$\text{Then}\left\{\begin{array}{l} 6,4632128 = \text{Value of } 1l. \text{ for 8 Years.} \\ 1,8594104 = \text{ditto for 2 Years.} \end{array}\right.$$

Remains 4,6030024

Which × 80 Annuity.

Gives £.368,304192 as before.

(40) Here is given $u = 1000$, $t = 20$, and $r = 1,05$. Which involved to the 20th Power = 2,6532977 per Table I.

Then per Theo. I, $\overline{1000 - \frac{1000}{2,6532977}} : \div \overline{1,05 - 1} =$ $\overline{1000 - 376,88948} \div ,05 = 623,11052 \div ,05 = 1246,22104 = p$.

Now per Rule II. $a = 124622104$, $t = 5$, and r as before; which being involved to the 5th Power = 1,276816.

Then per Theo. II. $\frac{1246,22104}{1,2762816} = 9767,60175 = 9767$ £. 12s. ,035.

Theorem, first $prt = A$, which change to P.

Then $\frac{\overline{prt \times r} - prt}{rt - 1} = U$, the Annuity.

(41) Here $p = 368,30419$, $t = 2$, and $r = 1,05$; which being involved to the 2d Power = 1,1025 per Table I.

Then per Theo. I. $368,30419 \times 1,1025 = 406,05536 = A$.

Now per Rule II. $p = 406,05536$, $t = 6$, and r as before; which being involved to the 6th Power = 1,3400956.

Then per Theorem II.

$$\frac{\overline{406,05536 \times 1,3400956} \times 1,05 - \overline{406,05536 \times 1,3400956}}{1,3400956 - 1}$$

$= \frac{571,360652 - 544,153002}{,3400956} = \frac{272,0765}{,3400956} = 80$ £. the Annuity required.

(42)

(42) Here for 8132,14,8 read 976,7£. 12s. 0¼ 78 = p = 9767,60175, t = 5, and r = 1,05; which being involved to the 5th Power, = 1,2762816.

Then per Theorem I. 9767,60175 × 1,2762816 = 12466,2103896 = A.

Now per Rule II. p = 12466,2103896, t = 20, and r as before; which being involved to the 20th Power = 2,6532977 per Table I.

Then per Theorem II.

$$\frac{\overline{12466,2103896 \times ,6532977 + 1,05} - 12466,2103896}{\overline{2,6532977 - 1}} \times 2,6532977 = \frac{34730,3057229 - 33076,56735457}{1,6532977}$$

$$= \frac{1,6538836}{1,6532977} = 1000£.$$ the Annuity.

69. REBATE or DISCOUNT.

Theorem XIII. $\frac{s}{rt} = p$, the preſent Worth.

(43) Here $\frac{s}{rt} = \frac{150}{1,2155063}$ = 123,40536, or 123£. 8s. 1¼d. preſent Worth required.

By the Table, thus, ,8227025 × 150 = 123,405375, as before.

(44) Here s = 743,2375, t = 6, and r = 1,04; which being involved into the 6th Power = 1,265319.

Then per Theo. 743,2375 ÷ 1,265319 = 587,391 = 587£. 7s. 9¾d. the Anſwer.

Theorem XIV. prt = S, the Sum owed.

(45) Here p = 123,405208, t = 4, and r = 1,05; which being involved to the 4th Power = 1,2155063 = pt.

Then per Theorem, 123,405208 × 1,2155063 = 150£. the Debt.

(46) Here p = 587,391, t = 6, and r = 1,04; which being involved to the 6th Power = 1,265319, per Table I.

Then per Theorem, 587,391 × 1,265319 = 743,237 = 743£. 4s. 9d. the Anſwer.

Theorem XV. $\frac{s}{p}=rt.$

(47) Here $p=123{,}405208$, $s=150$, and $r=1{,}05$.
Then per Theorem, $150\div123{,}405208=1{,}2155063=rt$; which being continually divided by $1{,}05$ till nothing remains, the Number of thoſe Diviſions will be 4, that is 4 Years, the Anſwer.

(48) Here $p=587{,}391$, $s=743{,}235$, and $r=1{,}04$.
Then per Theorem, $743{,}235\div587{,}339100=1{,}2653191$ which proceed with as directed in the laſt Example, and the Number of Diviſions will give 6 Years, the Anſw.

Theorem XVI. $\frac{s}{p}\ Rt.$

(49) Here $s=150$, $p=123{,}405208$, and $t=4$.

Then per Theo. $\frac{150}{123{,}405208}=1{,}2155063=r^4$.

$\because \sqrt[2]{1{,}2155063}=1{,}1025$, and $\sqrt[2]{1{,}1025}=1{,}05$ or 5 per Cent. the Anſwer.

(50) Here $s=743{,}235$, $p=587{,}3391005$, and $t=6$.
Then per Theo. $744{,}235\div587{,}3391005=1{,}265319=r^6$.

Then $\sqrt[2]{1{,}265319}=1{,}124864$.

And $\sqrt[3]{1{,}124864}=1{,}04$ or 4 per Cent. the Anſwer. (See the Guide, Page 208.)

70. PURCHASING FREEHOLD OR REAL ESTATES.

(51) Here $u=500$, and $r=1{,}05$.

Then per Theorem $\frac{1{,}05-1}{500}=\frac{500}{{,}05}=10000$£.

Theo. XVII. $\frac{u}{r-1}=$ P, the preſent Worth.

(52) Here $u=25$, and $r=1{,}045$.

Then per Theo. $\frac{25}{1{,}045-1}=\frac{\quad}{{,}045}=555{,}5=555$£. 11*s.* 1¼*d.* ,28, the Anſwer.

Theo. XVIII. $\frac{P+u}{p}=$ R, the Rate per Cent.

(52)

(53) Here $p=10000$, and $u=500$.

Then per Theo. $\frac{10000+500}{10000}=\frac{10500}{10000}=1,05$, or 5 per Cent. the Anſwer.

(54) Here $p=555,5$, and $u=25$.

Then per Theo. $\frac{555,5+25}{555,5}=\frac{580,5}{555,5}=1,045$ or 4½ per Cent. the Anſwer.

Theo. XIX. $P\times\overline{r-1}=U$, the Annuity.

(55) Here $p=10000$, and $r=1,05$.

Then per Theo. $10000\times\overline{1,05-1}=10000\times,05=,500$£. the Anſwer.

(56) Here $p=555,5$, and $r=1,045$.

Then per Theo. $555,5\times\overline{1,04,-1}=555,5\times,045=25$£ the Anſwer.

71. PURCHASING FREEHOLD ESTATES IN REVERSION.

Theorem XX. First $\frac{u}{r-1}=P$, which change to A.

Then $\frac{a}{Rt}=P$, the preſent Worth.

(57) Here $u=500$, and $r=1,05$.

Then per Theo. I. $\frac{500}{1,05-1}=\frac{500}{,05}=10000=P$. which change to a.

Then per Theo. II. $a=10000$, $t=4$, and r as before; which involved to the 4th Power $=1,2155063$.

Then per Theo. II. $\frac{10000}{1,2155063}=8227,024=8227$£. 5¾*d.* the Anſwer.

Theorem XXI. First $prt.=A$, which charge to P.

Then $\times\frac{prtr-pr}{r}$ = U, the Annuity.

(58) Here $p=8227,024$, $t=4$, and $r=1,05$; which being involved to the 4th Power $=1,2155063$.

Then per Theo. I. $,8227,024\times1,2155063=10000,=A$.

Now per Rule II.) $p=10000$, and r as before.

Then per Theo. II. $\frac{10000\times1,05\times1,05-10000\times1,05}{1,05}$

$=\frac{11025-10500}{1,05}=\frac{525,00}{1,05}$ 500£. the Anſwer.

QUESTIONS FOR EXERCISE.

(59) Firſt 486,5£. — 94 = 392,5£. the Annuity.

Now the preſent Worth of 1£. for 7, 14, and 21 yrs. at 5 per Cent. is 5,7863737, 9,8986409, and 12,8211427, (per Table V.)

Then £. s. d. Yrs.

$$\left.\begin{array}{r}5,7863737\\9,8986409\\12,8211527\end{array}\right\}\times362,5=\left\{\begin{array}{l}2271,1507=2271\ \ 3\ \ 0\\3885,21655=3885\ \ 4\ \ 4\\5032,30243=5032\ \ 6\ \ 0\end{array}\right\}\text{P.W. for}\left\{\begin{array}{r}7\\14\\21\end{array}\right.$$

(60) Firſt 15 + 5 = 20 yrs. and 186£. 7*s.* 6*d.* = 186,375£.

Then the Worth of 1£. for 20 yrs. = 13,5903253

And ditto for 15 yrs. = 11,1184858

Diff. 2,4719395

$\therefore$ 2,4719395 × 186,375 = 460,70753 = 460£. 14*s.* 1¾*d.* the Fine required.

(61) Firſt 7 + 14 + 10 = 31 Years.

Now the preſent Worth of 1£. at 5 per Cent. for 31, 21, and 7 yrs. is 5,7863734, 12,8211527, and 15,5928104.

Then *Years.*

$$\left.\begin{array}{r}15,5928104\\12,8211527\\5,7863734\end{array}\right\}\times50=\left\{\begin{array}{l}779,64082\\641,057635\\289,31867\end{array}\right\}\begin{array}{l}\text{Preſent Worth}\\\text{of 50£. for}\end{array}\left\{\begin{array}{r}31\\21\\7\end{array}\right.$$

$$\left.\begin{array}{lrrr} & \text{£.} & \text{s.} & \text{d.}\\ \therefore\ \ 289,31867 & =289 & 6 & 4\frac{1}{2}\\ \text{Alſo }641,057635-289,31867 & =351 & 14 & 9\frac{1}{2}\\ \text{And }779,64052-641,057635 & =138 & 11 & 7\frac{3}{4}\end{array}\right\}\text{Val. of}\left\{\begin{array}{l}\text{A's.}\\\text{B's.}\\\text{C's.}\end{array}\right.$$

(6) By Table V. thc preſent Worth of 300£. per Annum for 7 Ye2rs at 4 per Cent. is 6,002547 × 300 = 1800,61641.

Then	£.	s.	d.			
1800,61641 + 150 =	1950	12	4	Value of	A's	Offer.
6,002547 + 250 + 400 =	1920	10	3¼		B's	
6,002547 × 200 + 650 =	1850	8	2½		C's	
	1800	0	0		D's	

Hence it appears that A's Offer is better by above	50	than	B's
	100		C's
	150		D's

(63) Firſt 54,85 − 7,35 = 47,5£. the Annuity.

Now as the Payment is Half-yearly, we ſhall have *u* = 475 ÷ 2 = 23,75, *t* = 6, and *r* = 1,01; (ſee the Guide p. 223.) which raiſed to the 6th Power = 5,0756921, per Table V.

∵ 5,0756291 × 23,75 = 120,54768735 = 120£. 10*s* 11½*d*. the Anſwer.

(64) Firſt 153 − 50 = 103£. for 12 yrs. at 5 per Cent.

Then per Table VI. 1£. will purchaſe for 12 yrs. at 5 per Cent. an Annuity of ,1128254 per Annum.

Then ,1128255 × 103 = 11,6210162 = 11£. 12*s*. 5*d*. advance Rent.

∴ 16£. + 11£. 12,5 = 27£. 12*s*. 5*d*. the Anſwer.

(65) Firſt 44 − 20 = 24£. and 1,9487171 = Amount of 1£. for 7 Years.	=	£. 250	0	0
Then 1,9487171 × 24 = 46,9292104	=	46	18	7
At 10£. per Annum for 7 Yrs.	=	70	0	0
Anſwer		360	18	7

(66) Firſt 33,3 × 50 = 166,6 = 166£. 13*s*. 4*d*. Value of the Annuity.

Then per Table VI. 1£. for 12 yrs. at 4 per Cent. will purchaſe, 1065512, per Annum.

∵ 166,6 × ,1065512 = 177,587 = 177 £. 11*s*. 8¾*d*. the Anſwer.

(67) Firſt 237 − 10 = 227£. the Annuity.

Then the preſent Worth for 1£. for 4, 12, and 14 Years, is 3,5459505,8, 8632516, and 9,8986409. per Table V.

$$\left.\begin{array}{r}3,5459505\\8,8632516\\9,8986409\end{array}\right\}\times 227=\left\{\begin{array}{rcrrr} & & £. & s. & d.\\ 804,9307635 & = & 834 & 18 & 7\frac{1}{4}\\ 2011,9581132 & = & 2011 & 19 & 1\frac{3}{4}\\ 2246,9914843 & = & 2246 & 19 & 9\frac{3}{4}\end{array}\right.$$

	£.	s.	d.
Sum =	5063	17	6
Diſcount 4+12+14×5=30×5=	150	0	0
Anſwer, received	4913	17	6¾

73. SUPERFICIAL MEASURE.

EXAMPLES.

PROBLEM I.

	Ft.	′
(1) Multiply	17	7
by		6
Anſwer	105	6

	Ft.	′	″
(2) Multiply	47	8	0
by		8	4
	15	10	8
	381	4	0
Anſwer	397	2	8

	Ft.	′	″
(3) Multiply	7	10	0
by		8	6
	3	11	0
	62	8	0
Anſwer	66	7	0

	Ft.	′	″
(4) Multiply	64	7	0
	×	4	8
	43	0	8
	258	4	0
Anſwer	301	4	8

	Ft.	′	″	‴	⁗
(5) Mult.	12	8	9	0	0
		×	9	6	7
		7	5	1	3
	6	4	4	6	0
	114	6	9	0	0
Anſwer	121	6	6	7	3

	Ft.	′	″	‴
(6) Multiply	9	11	6	0
		×	11	8
	6	7	8	0
	109	6	6	0
Anſwer	116	2	2	0

(7)
Ft. ′ ″ ‴
6 | ½ | 64 0 10 0
14 9
½ | 32 0 5 0
16 0 2 6
896 11 8 0
Anſwer 945 0 3 6

(8)
Ft. ′ ‴ ″
6 | ½ | 124 4 0 6
4 | ⅓ | 42 0 9
½ | 5 2 2
2 7 1
14 0 0
248 0 0
496 0 0
Anſwer 5229 9 3

(9)
Ft. ′ ″ ‴ ⁗
16 7 10 0 0
6 5 7
0 9 8 6 10
6 11 3 2 0
99 11 0 0 0
Anſwer 107 7 11 8 10

(10)
Ft. ′ ″
6′ | ½ | 474 6 8
6 | ½ | 186 7 4
1 | ⅙ | 237 3 4 0 0
4″ | ⅓ | 39 6 6 8 0
13 2 2 2 8
93 0 0 0 0
8 | ⅑ | 10 4 0 0 0
2844 0 0 0 0
8532 0 0 0 0
Anſwer 88557 4 0 10 8

(11)
Ft. ′ ″ ‴ ⁗ v
6′ | ½ | 24 11 8 6 7 0
8 6 7
1 2 6 9 10 1
12 5 10 3 8 6
199 9 8 4 8 0
Anſwer 213 6 1 5 11 4

(12)
Ft. ′ ″ ‴ ⁗ v vi
4 | ⅓ | 46 6 8 4 0 0 0
6 4 8 6
6″ | ⅛ | 15 6 2 9 4 0 0
2 | ⅓ | 1 11 3 4 2 0 0
0 7 9 1 4 8 0
0 1 11 3 4 2 0
279 4 2 0 0 0 0
An. 297 7 4 6 2 10 0

PRO-

P R O B L E M II.

(1) Here AB=14,5, and AC=9,75 Chains, per Fig. 2.
Then per Theo. 14,5×9,75=141,375=141 *a.* 1*r.* 20 p. the Area required.

(2) Here AB=AC=245 yds. per Fig. 1.
Then 245×245=60025 Acres, or yds.
∵ 4840)60025 (12,42=12 A. 1*r*, 24p.

(3) Here A B =64 ft. 6 inc. and A C = 47 ft. 8 inc. ſee Fig. 3.
Then per Problem I. 64 ft. 6 inc. × 47 ft. 8 inc. =3074
∵ 9)3074 ft. 6 inc. (=341 yds. 5ft. 6 inc. the Anſwer.

P R O B L E M III.

(4) Here AB=28 and CD=20,5 Chains. See Fig. 4. G.
Then per Theo. $\frac{28\times20{,}5}{2}=14\times20{,}5=287$ Acres.

(5) Here AB=738, and CD=583 Links.
Then $\frac{738\times583}{2}=\frac{420254}{2}=215127$ Links or 2,15127 Acres.
∵ As 2,15127 : £. : : 1 : 5,5781=5£. 11*s.* 6*d*$\frac{3}{4}$. the Anſwer.

(6) Here $\frac{a+b+c}{2}=\frac{400+348+312}{2}=\frac{1060}{2}=530=s$.
Then per Rule.

$$530-\left\{\begin{array}{l}400=130=e.\\348=182=f.\\312=218=g.\end{array}\right\}\text{ the three Remainders.}$$

∵ 530×130×182×218=2733676400.
And $\sqrt{2733676400}=52284{,}5$
Then 4840)52284,5(10,8=10 acr. 3r. 8 p. the Anſwer.

P R O B L E M IV.

(7) Here AC=45, BF=17,25, and DE=14. See Fig. 5. G.
Then per Theo. $\frac{17{,}25+14}{2}\times45=\frac{31{,}25}{2}\times45=$ $15{,}625\times45=703{,}125$ ft. theſe ÷ 9= 78 yds. 1 ft. 18 inc: the Anſwer.

(8) Suppoſe AB=15,6, BC=13,2, CD=10, and AD=26.

Then per Rule, firſt $\frac{15{,}6+13{,}2+10+26}{2}=\frac{64{,}8}{2}=32{,}4$,

∴ $\sqrt{\overline{32{,}4-15{,}6}\times\overline{32{,}4-13{,}2}\times\overline{32{,}4-10}\times\overline{32{,}4-26}}=$ $\sqrt{16{,}8\times19{,}2\times22{,}4\times6{,}4}=\sqrt{402{,}42{,}2016}=215{,}04$ Area required. (See Queſt. 29, in Algebra.)

Or if the Trapezium can be inſcribed in a Circle, that is, if the Sum of any two oppoſite Angles be equal to two right Angles, or 180°; then multiply any two adjacent Sides together, and the other two Sides together, and multiply by the Sum of theſe Products, half the Sine of the Angle included by either of the Pair of Sides which are multiplied together, ſo ſhall this laſt Product be the Area.

Thus $\frac{AD\times DC+AB\times BC\times s+A,\ \text{or}\ s.\,C}{2}=$ the Area.

E X A M P L E.

If the Sides be AD=4, DC=7,5, AB=6, BC=5,5, and the Angle C=74° 40½.

Therefore the Angle A=180°—74° 40¼′=105° 19¾′.

Then by Rule $\frac{4\times6+7{,}5\times5{,}5}{2}\times{,}9644229$ (s. 74° 40¼′)

=31,46429+ ſq. Feet, the Area.

P R O B L E M V.

(9) Here AB=48, CD=41,57, and n=5.

Then per Theo. $\frac{48\times41{,}57\times5}{2}=\frac{9976{,}8}{2}=4988{,}4$ ft. the Area required.

(10) Firſt the Multiplier for an Hexagon is 2,598076 by the Table.

Then per Rule II. thus 2,598076×30×30=2338,2684, the Area.

(11) Here the multiplier for an Octagon is 4,828427 by the Table.

Then 4,828427×24×24=2781,173952, the Area.

PROBLEM VI

(12) Thus 3,1416×7=21,9912, or rather 22, the Circumference required, (per Rule I.)

(13) Thus 22 ÷ 3,1416 = 7 (nearly) the Dirameter, per Rule II.

(14) Thus 3,1416×8000=25132,8 Miles, the Circumference required.

PROBLEM VII.

(15) C=6,2832, $D=\frac{6,2832}{3,1416}=2.$

Then per Theo. $\frac{6,2832}{2}\times\frac{2}{2}=\frac{6,2832}{2}=3,1416$, the Area, (per Rule II.)

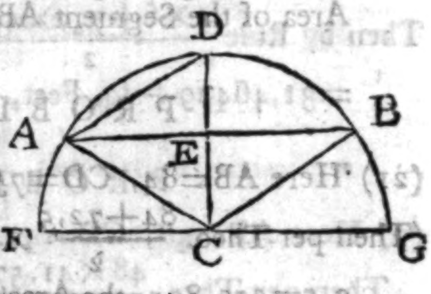
(16) First 12×12=144, Square of the Diameter.

Then ,7854×144=113,8976, the Area. (per Rule II.)

PROBLEM VIII.

(17) CC=9, ABD=29,5, and *b*=,01745329,

Then per Theorem, ,01745329 × 29,5×9= 4,633848495, the Length of the Arch required.



PROBLEM IX.

(18) Here AC=55, and AB=59; see Fig. 9.

Then per Theo. $55\times\frac{59}{2}=55\times26,5=1622,5$, the Area required.

Firſt, by Rule II. p. 181 G. ${}^{2}AC - {}^{2}CE = {}^{2}AE = 1764 - 144 = 1620$ ∵ $\surd 1620 = 40{,}249$ (nearly) $= AE$, which $\times 2 = 80{,}498$ the Baſe AB; and by Rule I. p. 181. $AE + {}^{2}DE = {}^{2}AD = 1019{,}982 + 900 = 50{,}2$ (nearly)—AE; which $\times 2 = 80{,}498$ the Baſe AB; and by Rule 28, p. 181, $AE \times {}^{2}DE = {}^{2}AD = 1619{,}982 + 900 = 2519{,}982$.

∵ $\surd 2519{,}982 = 50{,}2$ (nearly) the Chord of half the Arch AB, viz. AD.

Therefore $80{,}498 \times 6 + 50{,}2 \times 8 = 482{,}988 + 401{,}6 = 884{,}588$, Sum of the Product.

∵ $884{,}588 \times \frac{30}{15} = 884{,}588 \times 2 = 1769{,}{,}176$.

(20) Firſt, $,7854 \times 18 \times 18 = 254{,}4696$, the Area of the whole Circle, (per Prob. VII.)

∵ $\frac{254{,}4696}{4} = 63{,}6174$, Area of the Quadrant CABD; ſee the laſt Figure.

And $\frac{9 \times 9}{2} = \frac{81}{2} = 40{,}5$, Area of the Triangle, ABC, (per Prob. III.)

Then from 63,6174 take 40,5, remains 23,1174, the Area of the Segment ABD.

PROBLEM XI.

(21) Here $AB = 84$, $CD = 75{,}5$, and $AC = 3{,}5$ ſee Fig. 10.

Then per Theo. $\frac{84 + 72{,}5}{2} \times 3{,}5 = \frac{156{,}5}{2} \times 3{,}5 = 78{,}25 \times 3{,}5 = 273{,}895$, the Area required.

(22) Firſt, as $7 : 22 :: 24 : 75{,}4$, which $\div 2 = 37{,}7$, the greateſt Semicircle AB.

Again, as $7 :: 22 : 16 : 50{,}2$, which $\div 2 = 25{,}1$ leſſer CD.

Alſo $\frac{24 - 16}{2} = \frac{8}{2} = 4 = AB$; ſee Fig. 10.

Then $\frac{37{,}7 + 25{,}1}{2} \times 4 = \frac{62{,}8}{2} \times 4 = 31{,}4 \times 4 = 125{,}6$,

PROBLEM XII.

(23) Here AB =24, CD=18, and b =,7854.
Then per Theo. ,7854×24×18=339,2928, the Area.

OF ARTIFICERS WORK.

Ft. ′ ″
(1) 3 10 0
×2 8
2 6 8
7 8 0
10 2 8
×12
122 8 0 Content.

Ft. ′ ″
6*d*. | $\frac{1}{40}$ | 122 8 0 at 8½*d*.
2 | ½ | 3 1 0
½ | ¼ | 1 0 4
0 5 1
6′ | ½ | 0 0 4¼=½ of 8*d*.
2 | $\frac{1}{3}$ | 0 0 1¼
£. 4 5 10½ Value.

Ft. ′
(2) 6 6
5 3
4 9
Sum 16 6
×4
66 0
3 9
247 6 Content.

4*d*. | $\frac{1}{3}$ | 247 6 at 1*s*. 4*d*.
82 4
6′ | ½ | 0 8=½ of 16*d*.
2,0)33,0 0
£. 16 10 Anſwer.

By Decimals, thus 6,5+5,25+4,75=16,5, Sum of their Heights; which ×4, (the Number of Windows in a Tier) =66 Heights together.
Then 66×3,75 (the Breadth) =247,5 the Area.
Now 16*d*.=,06£. ∵ 247,5×,06=16,499, or, 16£. 10*s*. as before.

Ft. ′ ″
(3) 6 6 0
× 3 3

1 7 6
19 6 0

21 1 6 Content.

Ft. ′ ″
21 1 6 at 8*s.*
× 4

| 8 8 0
1′ | $\frac{1}{12}$ | 0 0 8 = $\frac{1}{12}$ of 8*s.*
6″ | ½ | 0 0 4

£. 8 9 0 Anſwer.

By Decimals, thus 3,25 × 6,5 = 21,125 ft. at 8*s.* or, 4 £.
∵ 21,125 × ,4 = 8,45 or £. 8 9*s.* as before.

(4) Firſt 16 × 2 = 32 the Length; and 9 × 3 = 27 the Breadth
Then 32 × 27 = 864, ſquare Inches.
∵ 144)864(6 ft. the Content required.

Ft. ′ ″
(5) 176 6 0
× 56 9 0

88 3 0
44 1 6
28 0 0
1056 0 0
880 0 0

9)100 16 4 6

6*d.* $\frac{1}{40}$ 1112 *yds.* 8 *ft.* 4 *inc.* 6 *ſec.* at 6*d.* *per Yard.*

27 16 0
+ 5½

£. 27 16 5¼ the Anſwer.

For the odd Parts thus
3 *Ft.* | ⅓ | 6*d.*
3 | | 2
| | 2 2
| | 0½ ⅔
4′ | ⅓ | 0½ ⅔
6″ | ⅛ | 2

5¼

By Decimals, thus 176,5 × 56,75 = 10016,375 Feet.
Then 9) 10016,375 (1112,93 yds. at 6*d.* or, 025 £. per yd.
∵ 1112,93 × ,025 = 27,823, or £. 27 16*s.* 5½*d.* the Anſw·
as before.

Ft. ′ ″
(6) 9 6 0
×8 3

2 4 6
76 0 0

9)78 4 6

yds. 8 6 4 6 at 6*s.*
×3

2 8 0
0 4 3

£. 2 12 3 the Anſwer.

For the odd Parts, thus

3 Ft.	$\frac{1}{3}$	6*s.*
		2
3	$\frac{1}{3}$	2
4′	$\frac{1}{6}$	0 $2\frac{1}{2}$ $\frac{2}{3}$
6″	$\frac{1}{8}$	0 $0\frac{1}{4}$ $\frac{1}{3}$
		4 3

By Decimals, thus 9,5×8,25=78,375 Feet.
Then 9)78,375(8,7083 yds. at 6*s.* or ,3£.
∵ 8,7083×,3=2,6125 or 2£. 12*s.* 3*d.* the Anſwer.

Ft. In.
(7) Firſt 84 ſt. × 9 ſt. 6 inc. = 798 0 Room.
And { 6 × 3·5=61,6 / 4 × 4- =16 } = 77 6 Win. and Chim.

9)720 6 Diff.

80 yds. 6 inc.

∵ 80 yds. × 2+6 inc. =160 yds. 6 inc. Anſwer.

Ft. Inc.
(8) Firſt 47 ſt. 7 inch.—4 ſt.=43 7 Breadth.
×47 7 Length.

9)2073 10 1

6*d.* | $\frac{1}{40}$ | yds. 230,3 10 1 at 6*d.* per yd.

		5 15 0
3 ſt.	$\frac{1}{3}$	2 = $\frac{1}{3}$ of 6*d.*
6 in.	$\frac{1}{6}$	$\frac{1}{4}$ $\frac{1}{2}$= $\frac{1}{6}$ of 2*d.*
4	$\frac{1}{9}$	0 $\frac{8}{9}$= $\frac{1}{9}$ of dit.

£. 5 15 $2\frac{1}{2}\frac{7}{18}$ the Anſwer.

Ft. In. Ft. In. Ft. In. ″

(9) 129 6 × 16 3 = 2104 4 6 Room.

7 × 3 9 = 13 1 6 } $\frac{1}{2}$ Doors and Shutters.

7 $\overset{2}{3}$ × 4 6 = 32 7 6 }

8,6 + 4,6 × 2 = 26, × 1,2, × 2 = 60 8 0 Cheek-board.

14 + 3,9 × 1,4 = 17,9, × 1,4 = 23 8 0 Door Linings.

Ft. In. Ft. 2234 5 6

To be deducted 8 9 × 3 = 11 3 0 Chimney.

9)2223 2 6 Wood-Work.

s. d.

2 6 | $\frac{1}{8}$ | yds. 247 2 6″ at 3*s.* 6*d.*

1 0 | $\frac{1}{20}$ | 30 17 6 } = 43£. 4*s.* 6*d.* the Coſt.

12 7 0 }

Ft. Inc. d. Yds. Ft.

(10) 34 6 6 | $\frac{1}{40}$ | 76 6 at $10\frac{1}{2}$ per yd.

× 20

3 | $\frac{1}{2}$ | 1 18

9)690 0 $1\frac{1}{2}$ | $\frac{1}{2}$ | 19

9 6

76 6 3 ft. | $\frac{1}{3}$ | 0 $3\frac{1}{2}$ = $\frac{1}{3}$ of $10\frac{1}{2}$*d.*

3 | $\frac{1}{3}$ | $3\frac{1}{2}$

£. 3 7 1

Ft. In.

(11) $6\frac{1}{2}$ 34 8

× 14 6

17 4

485 4

9)502 8

$\frac{1}{5}$ 55 yds. 7 ft. 8 inc. the whole Area.

11 1 $6\frac{2}{5}$ £. s. d.

Plaiſtered 44 6 $1\frac{3}{5}$ at 8*d.* per yd. = 1 9 $9\frac{1}{4}$

Whited 67 0 $2\frac{2}{5}$ at 2*d.* per yd. = 11 2

C c 2 Anſwer £. 2 0 $11\frac{1}{4}$

```
               Ft.   In.
(12)     6½ | 120    6
            |        12    9
            |  ------------------
            |   60    3    0
         3½ |   30    1    6
              1446    0    0
          ---------------------- Sq. Ft. In. ''
     1,00) 15,36    4    6(15, 36 4 6 the Anſwer.
          ----------------------
```

$$(13)\ \left.\begin{array}{l}\text{Firſt } 28\times20 = 560\\ \text{And } 14\times10\times2 = 280\end{array}\right\}=280 \text{ the Diff.}$$

1,00)840 Sum.

8,4 ſq. at 2£. 5*s.* or 2,25£.

∵ 2,25×8,4=18,9 or 18 £. 18*s.* the Anſwer.

$$(14)\ \left.\begin{array}{r}\text{Ft.}\quad\text{Ft.}\\ 30{,}5\times20{,}5\\ \\ 5{,}25\times6\\ 4{,}25\times4\\ 8{,}5\times10\end{array}\right\}\times4=\left\{\begin{array}{l}\text{Ft.}\\ 2501 \text{ Area of the 4 Floors.}\\ \\ 126=\text{dit. of 4 Fire-places.}\\ 68=\text{dit. of ditto.}\\ 340=\text{dit. of a Well-hole.}\end{array}\right.$$

The whole deductions = 534

1,00)19,67 ſq. at 8,5£.

∴ 19,67×85,=167,195=167£. 3*s.* 10¾*d.* the Anſwer.

(15) Firſt 1,25×15=18,75 Area of one Plank.
And 33,5×60,5=2026,75 ditto of the Room.
∵ 18,75(2026,75(108$\frac{7}{75}$ Planks, (nearly.)

(16) Firſt $36+\frac{36}{2}=36+18=54$ Width of the Roof.
Then 64×54=3456 Feet the Area.
And 1,00)34,56(34,56 ſqrs. at 12*s.* 6*d.* or,625£.
∵ 34,56×,625=21,6 or 21£. 12*s.* the Anſwer.

(17) Firſt 30×2=60, and 70×60=4200 ft. the Area.
Then 1,00)42,00(42 ſqr. at 10*s.* 8*d.* per ſqr.

s. *d.*
∵ 10 8
×7×6=42.

3 14 8
6

Anſwer £.22 8 0

(18) 22,75 } Flat and Half.
In. *Ft.* 11,375 }
10=8$\dot{3}$×2= 1,666$\dot{6}$=Eves Boards.

35,791$\dot{6}$ Whole Width.
×32,75 Length.

1,00)1172,17708$\dot{3}$(11,7217708$\dot{3}$ ſqr. at ,75£.

∵ 11,72177×,75=8,7913275=8£. 15*s.* 10*d.* (nearly) the Anſwer.

(19) Firſt 470 ft. ×9 ft. 6 inc. =4465 ft.
And 4465×6 half Brick.=26790.
Then per Rule I. 816)26790(32 rds. 226⅓ ft. the Anſw.

(20) Firſt 840×9=7560 Feet.
× 5 Half Bricks thick.

Per Rule II. 3)37800
Rds. *Ft.*
272)12600(46 88

Rds. *Ft.*
46 88 at 4£. 19*s.* 6*d.* per Rod.
×4

£. £. *s.* 184 0 at 4£.
46—1 3= 44 17 at 19*s.* 6*d.*
68 | ¼ | 1 4 10½=¼ of 4£. 19*s.* 6*d.*
17 | ¼ | 6 2½
3 | ⅙ | 1 0½ nearly.

£. 230 9 1½ the Anſwer.

(21)

(21) Firſt 38 ÷ 4 = 9,5 Height of the Gable.
And 40 ÷ 3 = 13,$\dot{3}$

$$\left.\begin{array}{l}\underline{24{,}5\times13{,}\dot{3}\times}\\24{,}5\times\ 9{,}5\div\end{array}\right.\left\{\begin{array}{ll}4=1306{,}66\dot{6} & \text{at }2\\3=980 & \text{at }1\tfrac{1}{2}\\2=653{,}33\dot{3} & \text{at }1\\2=116{,}375 & \text{at }\tfrac{1}{2}\end{array}\right\}\text{Bricks thick.}$$

$$816)3056{,}375(3{,}74555\text{ Rods}$$

∴ 3,745476 × 5,5 = 20,$\dot{6}$ or 20£. 12s. the Anſwer.

QUESTIONS.

(1) Firſt 14 ft. 3 inc. = 171 inc. and 3 ſquare ft. = 36 × 36 = 1296 Inches.
∴ 171)1296($7\frac{11}{19}$ Inches, the Anſwer.

(2) Firſt a Foot ſquare = 144 Inches.
Then 144 ÷ 27 = 5,$\dot{3}$ Inches, Breadth of the firſt Cut.
And 58 − 5,$\dot{3}$ = 52,$\dot{6}$ remaining Length.
Alſo 144 ÷ 52,$\dot{6}$ = 2,734 Breadth of 2d Cut.
Then 27 − 2,734 = 24,266 remaining Breadth.
144 ÷ 24,206 = 5,934 Breadth of 3d Cut.
52,$\dot{6}$ − 5,934 = 46,732 remaining Length.
144 ÷ 46,732 = 3,0814 Breadth of the 4th Cut.
24,266 − 3,0814 = 21,1846 remaining Breadth.
144 ÷ 21,1846 = 6,7974 Breadth of the 5th Cut.
46,732 − 6,7974 = 39,9346 remaining Length.
144 ÷ 39,9346 = 3,6059 Breadth of the 6th Cut.
21,1846 − 3,6059 = 17,5787 remaining Breadth.
144 ÷ 17,5787 = 8,1917 Breadth of the 7th Section.
39,9346 − 8,1917 = 31,7429 remaining Length.
144 ÷ 31,7429 = 4,5364 Breadth of the 8th Cut.
17,5787 − 4,5364 = 13,0423 remaining Breadth.
144 ÷ 13,0423 = 11,0409 Breadth of the 9th Sect.
Then 31,7429 − 11,0409 = 20,702 remaining Length.
Alſo 144 ÷ 20,702 = 6,956 Breadth of the 10th Section.
∴ 13,0425 − 6,956 = 6,0863 Breadth, remaining at the laſt. *Q. E. F.*

(3) Firſt 10584 ÷ 6 = 1764.
Then √1764 = 42 long Rows.
∴ 42 × 6 = 252 ſhort Rows, 42 in a Row.

(4) First $7\times2{,}5=17{,}5$ Inches, Area of an End.
And $17{,}5\times2=35$, double Area.
$\because$ $35\div3=11\frac{2}{3}$ Inches deep, the Anſwer.

(5) First $19\times11=209$, Area of an End,
Then $209\div4=52{,}25$ Area of an End of the Piece wanting.
$\because$ $52{,}25\div9=5{,}805$ Width required.

(6) First a yd. $=36\times36=1296$ Inches. And 3*s.* 2*d.*=38*d.*
Then, as 6*d.* : 1296 inc. :: 38*d.* : 8208 inc. Area of the whole Trough.
Alſo $102\times21\times2=4284$ Area of the two Sides.
$\because$ $8208-4284=3924$ Area of the Bot. and Ends.
Then $102+\overline{21\times2}=144$.
$\because$ $3924\div144=27\frac{1}{4}$ Inches, the Breadth required.

(7) First $26+40\times2=106$ Breadth of the Bot. and Sides.
Then $106\times74=7844$ Area of Bottom and Sides.
And $40\times26\times2=2080$ ditto of both Ends.
Alſo $26\times16\times3=1248$ ditto of the Stays.
144)11172(77,583 ſqr. Feet.
28 lb. ¼.)77,583(19,39583 cwt. at 22*s.* or 1,1£.
$\because$ $19{,}39583\times1{,}1=21{,}335416=$ 21£. 6*s.* 8½*d.* Value of the Ciſtern.
Now 3*s.* 6*d.*=,175£. Therefore $21{,}335416-{,}175=$ 21,160416 Maſon's Bill.
7*d.*=,02916)21,160215(725,5 ſq. Feet, Shop.
22 ft. 10 inc.=22,83)725,5(31,778=31 ft. 9¼ Inches, the Anſwer.

(8) First 27 ft. 112 inc.=4000 ſqr. Inches.
Then $20\times16\times2=640$ Area of the two Ends.
$\because$ $20\times2+16=$ 56)3360 ditto of Bot. and Sides.
12)60 Inches.
Anſwer 5 Feet.

(9)
Yds.
First 16½ ft. = 5,5
Then $5{,}5\times5{,}5=30{,}25$ } 1 Per. { Statute } Meaſure
And $6\times6=36$ } 1 Per. { Cheſhire } Meaſure
Alſo $7\times7=49$ } 1 Per. { Yorkſhire } Meaſure
Recip.

Recip. as 30,25 : 110 :: 36 : 92 1 28 Cheſh. } Meaſure,
30,25 : 110 :: 49 : 67 3 25 Yorkſh. } the Anſ.

(10) Firſt 7×4=28 ſqr. Feet, Area that each Plant takes.
∵ 3584×28=100352 ſqr. Feet, in all.
Square Feet in an Acre=43560)100352(2,303764 or 2 acr. 1 rd. $8\frac{1}{2}$ pol. the Anſwer.

(11) Firſt 18*d.*=,075)100(1333,3 Feet, the Area.
Now ſuppoſe Fig. 4, in the Guide, to repreſent the Court.

Then 133,3 $\div\frac{88}{2}$ = 1333,3 ÷ 44 = 30,303 = CD, the Perpendicular.
Then 44×44 = 1936 Square of A D, or B D.
Alſo 30,303×30,303 = 918,27 Square of D C.
$\sqrt[2]{2854,27}=53,425$ = AC, or BC.
And 53,425×2=106,85 the Sum required.

(12) Here the laſt-mentioned Fig. may repreſent the Form of the Bath.
Then 3)125(41,6=A B, or A C.
And 2)41,6(20,83=A D, or B D.
Then 41,6×41,6 = 1736,07
Alſo 20,83×20,83= 434,025
$\sqrt[2]{1302,052}=36,084$ = D C.
$∵\frac{36,084}{2}\times 41,6=751,75=751\frac{1}{4}$ the Area, per Prob. III.

(13) Square Order. Quincunx Order.

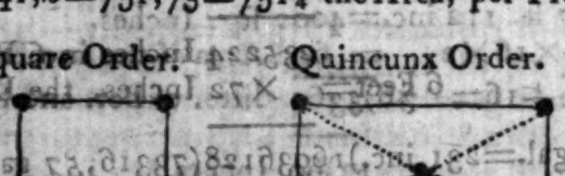


Fig. 23.

Firſt 6×6=36 ſqr. Feet each in the ſquare Order.
And 3×3= 9
$\sqrt[2]{27}=5,19615$
Then 5,19615×6=31,1769 ſqr. Feet each Plant in the Quincunx Order.
Now an Acre=43560 Feet.
∵ 43560×10=435600 ſqr. Feet in 10 Acres.

There-

Plants.
Therefore 31,1769)435600(13972 Quincunx } Order.
36)435600(12100 Square. }

Anſwer 1872

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(14) Firſt 10 + $2\frac{1}{2}$ + 1 = $13\frac{1}{2}$ or $\frac{27}{2}$ whole Breadth.
Then $\frac{27}{2} \times \frac{2}{9} = 3$ Feet, Riſe of the Roof.
And 13,5 ÷ 2 = 6,75 Half the Width.
Alſo 6,75 × 6,75 = 45,5625
3 × 3 = 9

$\sqrt[2]{54,5625} = 7,38664$ Length.

Then 13,5 × 2 × 7,38664 = 199,43928 Feet, the Area, at $3\frac{1}{2}$*d.* or ,014583£.
∵ 199,43928 × 0,14583 = 2,90849 or 2£. 18*s.* 2*d.* Anſ.

(15) Firſt, as 4,5 : 8 :: 9 A. to 16 B.
And 4 : 8,5 :: 16 : 34 = A's + C's.
Then 34 — 9 = 25 = C's.
∵ 9 + 16 + 25 = 50 = A's + B's + C's Area.
Now $\sqrt[2]{9} = 3$ A's, $\sqrt[2]{16} = 4$ B's, and $\sqrt[2]{25} = 5$ C's Side.
Alſo $\frac{3+4+5}{2} = \frac{12}{2} = 6$ Poles, the Area of the Triangle.
Therefore 272,25 × 144 = 39204 Inches in a Pole.
× 6 Poles

235224 Inches in 6 Poles.
6 Feet = × 72 Inches, the Depth.

A gal. = 231 inc.)16936128(73316,57 gals.

∵ 63)73316,57(1163,755 = 1163 Hhds. $47\frac{1}{2}$ galls. the Anſwer.

(16) Here ſuppoſe Fig. 5, in the Guide, to repreſent the Orchard; which contains 3,75 Acres.
Then AC = the Diagonal; and 430 + 360 = 790 = BF + DE, the Sum of the Perpendiculars; half of which is 395 Links, and 3,75 Acres = 375000 Links.
∵ 395)375000($949\frac{29}{79}$ Links = AC, the Diagonal.

(17) Firſt $3,1416 \times 16 = 50,2656$ Poles, the Circumſerence, (per Prob. VI. Rule I.)

Then $\frac{50,2656}{2} \times \frac{16}{2} = 25,1328 \times 8 = 201,0624$ Poles, the Area. (per Prob. VII.)

$\because$ 160)201,0624(1,2 Acre, the Anſwer.

(18) Firſt $16,5 \div 2 = 8,25$ one Round.

$\because$ 3,1416)8,2500(2,665 ft. or 3 ft. 7½ Inches, the Anſw.

(19) Firſt 3,1416)130,0000(41,38 ft. the Diameter.

Then $\frac{41,38}{2} \times \frac{130}{2} = 20,69 \times 65 = 1344\ 85$.

9)1344,85(149,428 yds. at 4*d.* or, 016 £.

$\because$ $149,428 \times ,016 = 2,490466$ or 2 £. 9*s.* 9½*d.* ,8, Anſwer.

(20) Firſt $4840 \div 2 = 2420$ yds. half an Acre.

Then ,7854)2420(3081,23 yds. Square of the Diameter, (per Prob. VII. Rule II.)

$\because$ $\sqrt[2]{3081,23} = 55,5$ Diameter.

Therefore $55,5 \div 2 = 27,75$ or 27¾ yds. the Anſwer.

(21) Firſt $\overline{42 + 14,5} \times 2 = 71$, greater Diameter.

Then $71 \times 71 = 5041$; alſo $5041 \times ,7854 = 3959,2014$

And $42 \times 42 = 1764$; alſo $1764 \times ,7854 = 1385,4456$

Diff. of their Areas, are 2573,7558

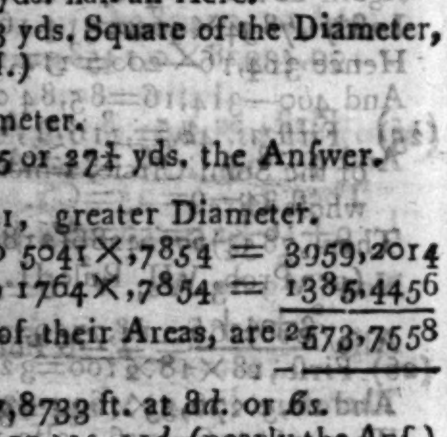
Then 144)2573,7578(17,8733 ft. at 8*d.* or 6*s.*

$\because$ $17,8733 \times ,6 = 11,9155$ or 11*s.* 11*d.* (nearly the Anſ.)

(22) Firſt, as $3,25 : 5 :: 60 : 92,307$ Circumference.

$\because$ $92,307 \div 3,1416 = 29,38$ Diameter.

And $29,38 \div 2 = 14,69$ Inches, the Anſwer. Fig. 24.



(23) Firſt $36 \times 36 \times ,7854 = 1017,8784$, Area of the whole Stone and Spindle-Hole. (per Prob. VII. Rule II.)

And $5 \times 5 \times 2 = 50$ Square of the Diameter of the Circle, circumſcribing the Spindle-hole; alſo $,7854 \times 50 = 39,27$ Area of ditto.

$\because$ $1017,8784 - 39,27 = 978,6084$, Area of the Stone to be divided.

Therefore,

$$\text{As } 20s. : 978,6084 :: \left\{\begin{array}{lll} \overset{s.}{7} : & 324,5129 & \text{A's} \\ 8 : & 391,4433 & \text{B's} \\ 5 : & 244,6521 & \text{C's} \end{array}\right\} \text{Area.}$$

Then 244,6521 + 39,27 = 283,9221, this ÷ ,7854 = 361,5, whoſe Square Root = 19,03 inc. the Diameter, where C begins to grind.

And 285,9221 + 391,4433 = 675,3654, this ÷ ,7854 = 859,9, whoſe Square Root = 29,324 inc. the Diameter where B begins to grind.

(24) Firſt 10 × 10 = 100; alſo 100 × 2 = 200, Area of the inſide Square.

Then $\sqrt[2]{200}$ = 14,142135 Side of the inſcribed Square.
Again 20 × 20 = 400 Area of the circumſcribed Square.
Laſtly ,7854 × 400 = 314,16 Area of the circular Section.
Hence 314,16 — 200 = 114,16 Inches, too little.
And 400 — 314,16 = 85,84 ditto, too much.

(25) Firſt 2*s.* 4*d.* = ,116£. : 1ft. :: 10£. : 85,7143 ft. Area of the Semi-Circle, which × 2 = 171,4286, Area of the whole Circle.

Then ,7854)171,4286(218,269 Square of the Diameter, (per Prob. VII. Rule II.

∵ $\sqrt[2]{218,26}$ = 14,7739 = 14 ft. 9¼ inc. the Anſwer.

(26) Firſt ,18 × 18 × 100 = 32400 French Fleet, the Arpent.
And 16,5 × 16,5 × 160 = 43560 Engliſh Fleet, in an Arp.
Then 16 × 16 = 256; alſo 15 × 15 = 225.
∵ Recipe 256 : 32400 :: 225 : 36864 Engliſh Fleet, in an Arpent.

So that the Engliſh Acre is to the Arpent of France, as 43560 : 36884, or : 605 : 512, nearly 13 : 11, or 1 : ,84628, the Anſwer.

(27) Firſt 3,1416 × 4 = 12,5664 Circumference of the Wheel.
∵ 12,5664 × 5 = 62,832 by the greater.
And 62,832 ÷ 2 = 31,416 by the leſs.

(28) Here (per Prob. IX. Fig. 9 in the Guide) is given CA = 30, and AB = 63 ft. = 21 yds.

Then per Theo. XXX. $30 \times \frac{21}{2} = 30 \times 10,5 = 315$ yds. Anſ.

(29)

(29) Firſt 15 Inches $=,41\dot{6}$ Yards.

Then $21-,41\dot{6}=20,58\dot{3}=$ AB, (See Fig. 22.)

And $20,58\dot{3}\div 2=10,291\dot{6}=$ AE.

Alſo $30\times 30=900={}^2$AC.

$10,291\dot{6}\times 10,291\dot{6}=105,92={}^2$AE.

Diff. $794,08={}^2$CE.

$\because\ \sqrt[2]{794,08}=28,18=$ C E, the Perpendicular.

Then per Prob. X. $30\times\frac{21}{2}=315$, Area of the Sector. A B C D.

And $10,291\dot{6}\times 28,18=290,1091\dot{6}$, Area of the Triangle. A B C.

$\therefore\ 315-290,01916=24,9808\dot{3}$, Area of the Segment: A B D.

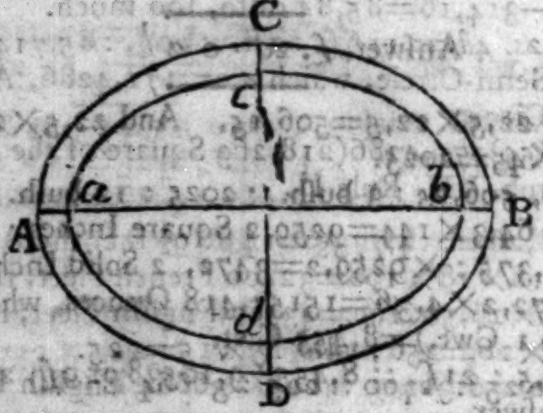


Fig 25.

(30) Firſt $14\times 2=28$ Inches; or $2,\dot{3}$ Feet.

	Lin.		Ft.		Lin.		Ft.	
Then, as	100	:	66	::	840	;	554,4	= *a b*.
	100	:	66	::	612	:	403,92	= c *d*.

$\because\ 554,4+2,\dot{3}=556,7\dot{3}=$ A B.

$403,92+2,\dot{3}=406,25\dot{3}=$ CD; then per Prob. XXVI.

$556,7\dot{3}\times 406,253\times,7854=177637,53=$ Area of ABCD

$554,4\times 403,92\times,7854=175877,17=$ ditto *a b c d*.

Covered by the Wall. 1760,36 Diff.

Now an Acre $=4840$ yds. $\times\ 9=43560$ ſt.

$\because\ 43560)175877,17(4,0375$ or 4 Acres, 6 Perches, Area of what they incloſe. (See Prob. XII.)

(31) Firſt 4×10=40 Feet, and 7×7=49 Square Side.
Then, as 4 : 49 :: 40 : 490 Square of the Diameter.
∵ $\sqrt[2]{490}$=22,136 Inches, nearly the Diameter required.

(32) Firſt 6×6=36. And 3×3×4×2=72.
Then, as 36 : 3 :: 72 : 6 Hours, the Anſwer.

(33) Firſt 9×9=81. And 12×122=288.
Then, as 81 : 22lb. :: 288 : 78$\frac{2}{9}$lb. the Anſwer.

(34) Firſt 1,25×1,25×20=31,25 Feet.
And $\frac{7}{8}$=,875; then ,875×875×50=38,28125 Feet.
∵ As 31,25 : $\frac{1}{2}$ Ton, or 1120lb. :: 38,28125 : 1372lb. at 3$\frac{1}{2}$*d.* per lb.

d.		*lb.*		
3	$\frac{1}{80}$	1372		
$\frac{1}{2}$	$\frac{1}{6}$	17	3	
		2	17	2
Anſwer. £.		20	0	2

(35) Firſt 22,5×22,5=506,25. And 22,5×2=45.
Alſo 45×45=2025.
Then, as, 506,25 : 3 buſh. :: 2025 : 12 buſh. the Anſw.

(36) Firſt 64,3×144=9259,2 Square Inches.
And $\frac{3}{8}$=,375 : ×9259,2=3472, 2 Solid Inches.
Then 3472,2×4,36=15151,418 Ounces, which ÷ 1792 (oz. in 1 Cwt.)=8,455 Cwt.
∵ As 19,5 : 21£. :: 8,455 : 9,10538 or 9£. 2*s.* 1$\frac{1}{4}$*d.*648 the Anſwer.

74. MEASUREMENT OF SOLIDS.

PROBLEM XIII.

(1) Thus 2,5×2,5×2,5=15,625 Feet, the Solidity.
(2) Firſt 57×42×34=81396 Cubic Inches.
A Gal of Ale=282)81396(288,638 Gal. the Anſwer.
(3) Firſt 4,5×4,5×,7854=15,90435 Area of the Baſe (per Prob. VII. Rule II.)
Then 15,90435×8=127,2348 Feet, the Content req.

PROBLM XIV.

(4) Thus 10,5×7,75=81,375, the Surface required.

PROBLEM XV.

(5) Firſt $12\times12=144$ Area of the Baſe.

Then $144\times\frac{25}{3}=144\times8{,}3=1200$ Feet, the Anſwer.

(6) Now (per Prob. III. Rule III.) $5{,}5\times3=16{,}5$ Sum of the three Sides, half of which is $=8{,}25$.

Then $8{,}25-5{,}5=2{,}75$ Difference.

And $8{,}25\times2{,}75\times2{,}75\times2{,}75=171{,}57421875$.

Then $\sqrt[2]{171{,}57421875}=13{,}0986=$ Area of the Baſe.

$\because\ 13{,}0986\times\frac{30}{3}=13{,}0986\times10=130{,}986$, the ſolid Content required.

(7) Firſt $3.5\times3.5\times{,}7854=9{,}62115$ Area of the Baſe, (per Prob. VII. Rule II.)

Then $9{,}62115\times\frac{6}{3}=9{,}62115\times2=19{,}2423$, the Solidity required.

PROBLEM XVI.

(8) Thus $\frac{3{,}25\times20}{2}\times3=\frac{65}{2}\times3=32{,}5\times3=97{,}5$ Area of the three Sides.

$$\begin{array}{lrcl}
\text{Now} & 3{,}25\times3{,}25 & = & 10{,}5625\\
\text{And} & 1{,}625\times1{,}625 & = & 2{,}640625\\
\hline
 & \text{Diff.} & & 7{,}921875
\end{array}$$

$\because\ \sqrt[2]{7{,}921875}\ =\ 2{,}81458$

Therefore $\frac{3{,}25\times2{,}81458}{2}=4{,}5737$ Area of the Baſe.

Now, $97{,}5+4{,}5737=102{,}0737$, the Area required.

(9) Thus $\frac{45\times20}{2}=\frac{900}{2}=450$ Feet, the convex Surface required.

PROBLEM XVII.

(10) Firſt $15\times15=225=A$. And $6\times6=36=a$. Alſo $h=24$.

Then per Theorem $225\times36=8100$.

And $\sqrt{8100}=90$ the mean Prop.

$\because\ 225+36+90\times\frac{24}{3}=351\times8=2808$ Inches.

Therefore 144)2808(=19,5 Feet, the Solidity.

Or thus, to the Squares of the $\left\{\begin{array}{l}\text{Diameters}\\ \text{Circumference}\end{array}\right\}$ of the Ends, add their Product: multiply the Sum by the Altitude of the Fruſtrum, and the Product which ariſes by $\left\{\begin{array}{l},2618\\ ,0265\end{array}\right\}$, viz. $\left\{\begin{array}{l},7854\\ ,0795\end{array}\right\}\div 3$

And this laſt Product will be the Content.

(11) Now by the preceding Rule 20×20=400.

And 3×3=9. Alſo 20×3=60, which are the Squares of the Diameters and the Product.

Then 400+9+60=469 their Sum.

∵ 469×60=28140, which × ,2618 = 736,7052, the Content.

(12) Firſt 66×66=4356. And 56×56=3136.

Alſo 66×56=3696, which are the Square of the Circumferences and their Product.

Then 4356+3136+3696=11188, their Sum.

∵ 11188×4×,0265=1185,928 the Content.

PROBLEM XVIII.

(13) Firſt 3 ft. 4 inc.+2 feet 2 inc.×4=40+26×4=66×4=264 Inches, Sum of the Perimeters.

Then $\frac{264\times10}{2}=\frac{2640}{2}=1320$ Inches.

∵ 12)1320(=110 Feet, the Surface.

Or thus, $\frac{3,\dot{3}+2,1\dot{6}\times4\times10}{2}=\frac{5,5\times4\times10}{2}=220\div2=$ 110 Feet.

(14) Firſt 32+8=40, Sum of the Circumference.

Then $\frac{40\times7}{2}=\frac{280}{2}=140$ Feet, the Content.

(15) Firſt, as 30 : 10 :: 6 : 2, Circumference of the Top of the Fruſtum.

And 30−6=24 the ſlant Height.

Then $\frac{10+2\times24}{2}=\frac{288}{2}=144$ Feet, the Surface required.

PROBLEM XIX.

(16) Firſt $30\times16\times\frac{12}{2}=480\times6=2880$ ft. the Content.

PROBLEM XX.

(17) Firſt $16+\overline{36\times2}=16+72=88$, Sum.

Then $88\times20=1760$.

Alſo $1760\times\frac{12}{6}=1760\times2=3520$ cubic Feet.

PROBLEM XXI.

(18) Firſt $16\times16=256$. And $13\times13=169$.

Alſo $16\times13=208$, which are the Areas of the Ends, and the Product of their Sides.

Then $256+169+208=633$ Sum.

∴ $633\times\frac{60}{3}=633\times20=12660$, the Content req.

PROBLEM XXII.

(19) Firſt $304\times20=6080$. And $300\times16=4800$.

Alſo $304+300\times\overline{20+16}=604\times36=21744$.

Now $6080+4800+21744=32624$, their Sum.

Then $32624\times\frac{5}{6}=32624\times,83=27186,6$, the Content required.

PROBLEM XXIII.

(20) Firſt (per Prob. VI.) $3,1416\times7=21,9912$ the Circumference.

Then $21,9912\times7=153,9384$, the Surface required.

(21) Thus $3,1416\times12\times12=452,3904$, the Surface.

(22) Firſt $7957,75\times3,1416=25000,6674$ Miles, (nearly) the Circumference, (per Prob. VI. Rule I.)

Then $7957,75\times25000,6674=198944286,35235$ ſquare Miles, the whole Surface required.

(23) Firſt $3,1416\times42=131,9472$ the Circumference.

Then $131,9472\times9=1187,5248$ the Surface required.

PROBLEM XXIV.

(24) Thus $7\times7\times7\times,5236=179,5948$, the Solidity required, (per Rule II.)

(25) Firſt, the Surface is 198944286,35235 Miles, (per Prob. XXIII. (See Ex. 22.)

Then $198944286{,}35235\times\frac{7957{,}75}{6}=198944286{,}35235\times 1326{,}2916=263858149120{,}06886875$ Miles, the Solidity required, (per Rule I.)

By Rule II. thus $\overline{7957{,}75}|^3\times{,}5236=263857624944$ the Solidity by this Rule.

The Difference ariſes by taking the Number ,5236 a little too great.

PROBLEM XXV.

(26) Firſt $\overline{18=3}-\overline{4\times 2}=54-8=46$.

Then $46\times4\times4\times{,}5236=385{,}3696$, the Content.

PROBLEM XXVI.

(27) For an Oblate, thus

$,5235\times33\times55\times55=52258{,}3875$ ſolid Inches.

Then 1728)52258,3875(30,242+ſolid Feet.

For an Oblong, thus $,5235\times55\times33\times33=31355{,}0325$ ſolid Inches.

∵ 1728(31335,0325(=18,1452 ſolid Feet.

PROBLEM XXVII.

(28) Firſt, $41888\times36\times36\times99=53743{,}97952$ ſolid Inc.

Then 1728)53743,97952(31,10184 Feet, the Content required.

By Rule II. Thus $,7854\times36\times36=1017{,}8784$. Area of the grerteſt Circle, (per Prob. VII. Rule II.)

∵ $1017{,}8784\times99=100769{,}9616$.

Which $\div 15=6717{,}99744=\frac{1}{15}$

Therefore $6717{,}99744\times8=53743{,}97952$ ſolid Inches, as before.

PROBLEM XXVIII.

(29) By Rule I. Thus, firſt $42\div4=10{,}5$ Quarter Girth.

And $10{,}5\times10{,}5\times16=1764$ Inches.

∵ 144)1764(12$\frac{1}{4}$ Feet, the Content by this Rule.

By Rule II. Thus, firſt 42 ÷ 5 = 8,4 = $\frac{1}{5}$ of the Girth.

And 16 × 2 = 32 twice the Length.

Then 8,4 × 8,4 × 32 = 2257,92 Inches.

∵ 144)2257,92(15,68 Feet, the true Content.

(30) By Rule I. Thus 64 ÷ 4 = 16.

Then 16 × 16 × 30,5 = 7808 Inches.

Theſe ÷ 144, gives 54, 2 Feet, the Content by this Rule.

By Rule II. Thus, 64 ÷ 5 = 12, 8. And 30,5 × 2 = 61.

Then 12,8 × 61 = 9994,24 Inches.

∵ 144)9994,24(69,4 Feet, (very nearly) the true Content.

Note, the firſt Rule differs from the Truth about $\frac{1}{4}$ of its Contents; that is, when it produces 4 for the Content, it ſhould be above 5. The ſecond Rule is about 5 Times nearer to the Truth than the other, for it differs from the Truth only a Foot in 190; and it is full as eaſy in Practice, beſides it hath in every Reſpect the Advantage of it. Therefore, I think it ought to be brought into general Uſe among the Meaſurers of Timber, who ſhould certainly prefer Truth to ſuch groſs Errors as are always introduced by the other Method.

(31) Firſt 42 × 30 × 40 = 50400.

Then 144)50400(350 Feet, the Content.

∵ 5,0)35,0(7 Tons the Anſwer.

PROBLEM XXIX.

(32) Firſt, 16 ft. 6 inc. = 198 inc. and 7 ft. 4 inc. = 88 ditto.

Then 198 × 88 = 17424 Area.

∵ 17424 ÷ 282 = 61,78 Gallons.

Or you may turn or change any Diviſor into a Multiplicator, by dividing Unity or 1 by that Diviſor.

$$\text{Thus, } 1{,}000000 \div \begin{cases} 282 = {,}003546 \text{ Ale.} \\ 231 = {,}004329 \text{ Wine.} \\ 268\,8 = {,}003722 \text{ Corn.} \end{cases}$$

Therefore 1724 × ,003546 = 6,178 Gallons, as before

33) Firſt, 58 ft. 6 inc. = 702 inc.

Then 702 × 94 ÷ 2 = 65988 ÷ 2 = 32994 Inches Area.

∵ 32994 ÷ 282 = 117 Gallons.

Or thus, 32994 × ,003546 = 117 Gallons as before.

(34) Firſt 84,5 × 50 = 4225 Area.

Then 4225 ÷ 282 = 14,9¼ Gallons.

(35) Here by Prob. 3. the Area of the Top is 1772,8, and at the Bottom 4209,727.

Then by Prob. 7th. $4209,727 \times 1772,8 = 7463004,0256$, whoſe ſquare Root $= 2731,85$ the mean Proportion.

Now $2731,85 + 1772,8 + 4209,727 \times \frac{36}{3} = 8714,377 \times 12 = 104572,524$ Cubic Inches.

$$\therefore 104572,524 \div \left\{\begin{array}{l} 282 = 370,824 \text{ Ale Gallons.} \\ 231 = 452,6 \text{ Wine ditto.} \end{array}\right.$$

(36) Firſt, by Rule II. $60,5 \times 60,5 \div 359,05 = 3660,25 \div 359,05 = 10,2$ Gallons nearly, Area of the Baſe.

Then by Prob. 15, $10,2 \times \frac{42,8}{3} = 10,2 \times 14,2\dot{6} = 145,52$ Ale Gallons.

Again $3660,25 \div 294,12 = 12,5$

$\therefore 12,5 \times \frac{42,8}{3} = 178$ Wine Gallons.

(37) Firſt by Prob. 7th, $84 \times 84 \times ,7854 = 5541,7824$ Area at Top.

And $62 \times 62 \times ,7854 = 3019,0776$ Ditto Bottom.

Now by Prob. 17th, $5541,7824 \times 3019,0776 = 16731071,10791424$.

$\because \sqrt[2]{16731071,10791424} = 4090,3632$ Mean Propor.

Then $4090,3632 + 5541,7824 + 3019,0776 = 12651,2232$

And $12651,2232 \times \frac{42}{3} = 12651,2232 \times 14 = 177117,1248$ Cubic Inches, which $\div 282 = 628,0749$ Ale Gallons.

By RULE I.

$$\begin{array}{lrl} (38)\ \text{Thus } ,7854 \times 32 \times 32 \times 2 & = & 1608,4992 \\ ,7854 \times 26 \times 26 & = & 530,9304 \\ \hline \text{their Sum} & = & 2139,4296 \\ \text{which Multiply by } \frac{40}{3} & = & 13,\dot{3} \\ \hline & & \text{gives } 28525,728 \text{ cubic Inc.} \end{array}$$

$$\therefore \left.\begin{array}{l} 282)28525,728(101,155 \text{ Ale} \\ 231)28525,728(123,488 \text{ Wine} \end{array}\right\} \text{Gallons.}$$

By RULE II.

$$\begin{array}{lrl} (39)\ \text{Firſt } 36 \times 36 & = & 1296 = \text{Square of the Head.} \\ \text{And } 40 \times 40 \times 2 & = & 3200 = 2 \text{ Ditto of the Bung.} \\ \hline \text{Their Sum} & = & 4496 \end{array}$$

Now $40-36=4$. And $4\times4=16$, $\frac{2}{5}$ of which $=6,4$.
Then $4496-6,4=4489,6$
$\because$ $4489,6\times64=287334,4$.
Therefore

$$287334,4 \div \left\{\begin{matrix},00092837=266,75 \text{ Ale} \\ ,00113333=325,64+\text{Wine}\end{matrix}\right\} \text{Gallons'}$$

Or $1077,157)287334,4(266,75$ Ale } Gallons, as be-
$882,35)287334,4(325,64$ Wine } fore.

QUESTIONS.

(1) Firſt $6\times6\times6=216$ Solid Inches in $\frac{1}{2}$ a Foot ſolid.
And $2)1728$

$\because$ $216)864($ ſolid Inches in $\frac{1}{2}$ a ſolid Foot.

Anſwer 4 Times as much as the firſt; or one is $\frac{1}{4}$ of the other.

	Ft.	In.	Ft.	In.	Ft.		Ft.	In.	''
(2) Firſt	25	6 ×	20	2 ×	14	=	7199	6	0
$\frac{1}{2}$ =	12	9 ×	10	1 ×	7 × 2	=	1799	10	6

which is juſt $\frac{1}{4}$ of the firſt; or as 4 is to 1, the Anſwer.

	Ft.	In.	Ft.	In.	Ft.	In.		Ft.	In.	''
(3) Firſt	17	7 ×	13	10 ×	9	6	=	2310	8	11
And	5	6 ×	2	1 ×	9	6	=	108	10	3
Remains								2201	10	8
Fire-Place, and Windows					27 × 4		=	108	0	0
Anſwer								2309	10	8

(4) Firſt $112,5\times32\times5,5=19800$ in the whole Hold.
Alſo $112,5\times4,5\times5,5=2784,375$ Gang-Way.

Remaining Concavity, $17015,625$

Then $3,\dot{3}\times2,1\dot{6}\times3=21,\dot{6}$, Content of 1 Bale.

$\because$ $21,\dot{6})17015,625(785,3365$ Bales, the Anſwer.

(5) Firſt a Fodder of Lead=2184 lb.
Then 16)2184(136,5 ſquare Feet.
∵ 4,25×8=34 Area of the Bottom.
Alſo 136,5—34=102,5=Area of the Sides and Ends.
8×2+4,25×2=16+8,5=24,5 round.
Then 24,5)102,5(4,183673 Feet, =50,204 Inches.
∵ 50,204+,75=49,454 Depth taken at.
Now 8 ft.=96 inc. Length, and 4½ ft.=54 inc. Breadth.
Therefore 96×54×49,454=242126,7846 cubic Inc.
∵ 231)242126,7846(1048,1679 Gallons (nearly;) which ÷63=16 Hhds. 40 Galls. (nearly) Anſwer.

(6) Firſt 18 inc.=1,5 ft. Alſo 14=1,16 ft.
Then 1,16×1,5=1,75 Breadth and Depth.
∵ 1,75)2,5(1,42857 Length of the Piece cut off.
Therefore 18,5—1,42857=17,07143 Feet, the Anſwer.

(7) Firſt 8,5)126,25(14,853 ft.=2138,8234 Inches, Area of an End.
∵ 38,5)2138,8234(55,55 Inches deep, the Anſwer.

(8) Firſt 18,5×18,5×,7854×8=2150,4252 cubic Inches in a Buſhel.
Now 7 ft. 10 inc.=94 inc. Length; 3 ft. 10 inc.=46 inc. in Breadth; and 4 ft. 2 inc.=50 inc. Depth.
Then 94×46×50=216200 cubic Inches in the Bin.
∵ 2150,4252)216200,0000(100,5 Buſh. or 12 qrs. 4½ Buſh. the Anſwer.

(9) By the laſt Queſtion a Buſhel=2150 4252 Inches.
Then 2150,4252×9=19353,8268 Inches, the Content.
∵ 19353,8268÷12=1612,8189 Area of the Circle.
Which ÷,7854=2053,49 Square of the Diameter.
And $\sqrt[2]{2053,49}$=45,3 Inches, the Anſwer.

(10) Firſt 28÷2=14 Radius. And 14×14=196.
Alſo 7×7=49. Then 196—49=147.
Then $\sqrt[2]{147}$=12,1243557 Perpendicular.
∵ 12,1243557×7=84,8705, Area of one Triangle.
And 84,8705×6= 509,223, Area of the Baſe.
Alſo 14×6×134=11256, ditto Sides.
Other Baſe 509,223

		Yds.	*Ft.*	*Inc.*
A yd.=Inc.	1296)12274,446(	9	4	34 Superf.

Again $509{,}223\times134=68235{,}88$ ſolid Inches.

∴ 1728)68235,88(39 ſolid Feet, 84 Inc. the Anſwer.

(11) Firſt 3 cubic Feet $=5184$ cubic Inches.

As the Circumference is 44, the Diameter is 14, (per Prob. VI.)

Then $\frac{44}{2}\times\frac{14}{2}=22\times7=154$, Area of an End, (per Prob. VII. Rule I.)

∴ 154)5184(33,66 Inches, the Anſwer.

(12) Firſt $1{,}25\times1{,}25\times{,}7854=1{,}2271875$, Area of the Circle, (per Prob. VII. Rule II.)

And a Pint contains 28,875 cubic Inches.

∴ 1,227187)28,875(23,5294 Inches, the Anſwer.

(13) A Buſhel contains 2150,4252 cubic Inches, (per Queſt. VIII.)

And $13{,}5\times8=108$ Buſhels, in $13\frac{1}{2}$ qrs.

Then $2150{,}4252\times108=232245{,}921$ cubic Inches.

∴ $\sqrt[3]{232245{,}9216}=61{,}468+$, the Anſwer.

(14) Firſt $20\times15\times8=2400$ cubic inches in the Stone,

And 290 Tons $=649600$ lb.

∴ As 220 : 2400 :: 649600 : 7086545 Inches.

Then 1728)7086545(4101 Feet the Anſwer.

(15) A Piece of Timber a Foot long, and 4 Feet round, is a ſolid Foot, cuſtomary Meaſure.

Alſo if a Circle be 4 Feet round, its Diameter will be $4\div3{,}1416=1{,}2732$, (per Prob. VI.)

Then a circular piece of Timber 1 Foot in Length, will contain 1,2732 Feet.

Therefore $1{,}2732\times50$ (Feet in a Load) $=636615$ ft.

∴ $63{,}6615-50=13{,}6615$ Feet in a Load, the Anſw.

(16) *Sol. Inc.*

$$20\times20\times20\times\left\{\begin{array}{l}{,}7854=6283{,}2\ \text{Cyl.}\\ {,}5236=4188{,}8\ \text{Globe.}\\ {,}2618=2094{,}4\ \text{Cone.}\end{array}\right\}\begin{array}{l}\text{See Prob.}\\ \text{XIII. XV.}\\ \text{and XXIV.}\end{array}$$

Now if the Diameter of a Circle be 20, the Circumference will be $3{,}1416\times20=62{,}832$, (per Prob. VI.)

Alſo if the Height (C D) of a Cone=20, and the Diameter of the Baſe A B=20.

Then $A\,D=\frac{20}{2}=10\ \therefore\ \frac{62,832\times10}{2}=314,16$ Area of the Cone's Baſe. (See Fig. 10 in the Guide.)

Then $\overline{\underset{2}{20}\times20}+\overline{10\times10}=400+100=500={}^2A\,C$.

$\because\ \sqrt{500}=22,36067614=A\,C$, the ſlope Side.

Then $314,16\times2=628,32$ Area of the two Baſes,

And $62,832\times20=1256,64$

$$\left.\begin{array}{ll} \text{Cylinders} & 1884,96\text{ Superficial Con.} \\ 62,832\times20= & 1256,64\text{ Globe's ditto.} \\ \frac{62,832}{2}\times22,36067+\Big\} & =1016,6428\text{ Cone's ditto} \end{array}\right\}\begin{array}{c}\text{See Pr.}\\ \text{XVI.}\\ \text{and}\\ \text{XXIII.}\end{array}$$

their Sum =4158,2428 Inches, their Area.

A Yard=1296 : 8 : : 4158,2428 : 25,6 or 2*s.* 1½*d.* the Anſwer.

(17) Firſt 2170×2170×2170×,5236 = 5350308686,8 ſolid Miles, (per Prob. XXIV.)

Then a Mile=1760×1760×1760=5451776000 ſolid Yards.

$\because$ 5350308686,8×5451776000=29168684491287756800 ſolid Yards in the Moon.

Now in a ſolid Yard are 36×36×36=46656 ſolid Incs.

Therefore 29168684491287756800 × 46656 = 1360894143625521581260800 ſolid Inc. in the Moon.

Then per Queſt. VIII. a Quarter = 2150,425×8 = 17203,4)1360894143625521581260800(791061152810212854 0,06 Quarters of Wheat, the Moon would hold, if hollow. *Q. E. F.*

Again 2170×2,1416=6817,272 Circumference of the Moon, (per Prob. VI.)

Then per Prob. XXIII. 6817,272×2170=14793480,24 Square Miles, the ſurface of the Moon.

A mile=1760×1760=3097600 ſquare Yards.

$\because$ 14793480,25×3097600 = 45824284391424 ſquare Yards of Stuff. *Q. E. F.*

(18) Firſt $7970+\overline{60\times2}=7970+120=8090$ Diameter of the Earth and Atmoſphere.

Then $7970 \times 7970 \times 7970 \times ,5236 = 265078559622$ ſol. Miles in the Globe of the Earth, (per Prob. XXIII.)

Alſo $8090 \times 8090 \times 8090 \times ,5236 = 277233177544,4$ ſol. Miles in the Earth and Atmoſphere.

$\because 277233177544,4 - 265078559622,8 = 12154617921,6$ ſolid Miles in the Atmoſphere.

And per the laſt Queſt. a Mile $= 5451776000$ ſolid Yards. Then

$12154617921,6 \times 5451776000 = 66264254274148761600$ ſolid Yards in the Atmoſphere. *Q. E. F.*

(19) Firſt 30 In. $= 2,5$ Feet.

Then $2,5 \times 2,5 = 6,25$ Area of the Baſe.

$\because 6,25 \times \frac{21}{3} = 6,25 \times 7 = 43,75$ ſolid Feet, (per Prob. XV.)

Then $21 \times \frac{2,5}{2} = 21 \times 1,25 = 26,25$ Area of one triangular Side, (per Prob. III.)

$\because 26,25 \times 4 = 105$ Area of the four Sides.

		£.	s.	d.
Now 43,75 at 7*s.*	=	15	6	3
And 105 at 8*d.*	=	3	10	0
Anſwer Coſt		18	6	3

(20) In order to complete the Cone, uſe this Analogy: as half the Difference of the Top and Bottom are to the Depth, ſo is half greater Diameter to the Altitude of the whole Cone.

Thus $\frac{72-54}{2} = \frac{18}{2} = 9$. Alſo $\frac{72}{2} = 36$.

Then as $9 : 42 :: 36 : 168$ Altitude.

$\because 72 \times 72 \times ,7854 \times \frac{168}{3} = 228004,7616$ Area of the whole Pyramid, (per Prob. XV.)

Again $\frac{168-42}{3} = \frac{126}{3} = 42 = \frac{1}{3}$ Altitude of the Piece wanting.

Then 54×54×,7854×42 = 96189,5088 Area of the Piece wanting.

Therefore 228004,7616−96189,5088 = 131815,2528 cubic Inches.

∵ 282)133815,2528(467 Gals. $3\frac{61}{141}$ pts. the Anſwer.

(21) Firſt $16+\frac{16}{5}=16+3,2=19,2$ Bottom Diameter.

And 19,2×8=153,6 the Height.

Alſo 153,6÷3=51,2 cylindrical.

153,6−51,2=102,4 a conical Fruſtrum.

Now 19,2×19,2×,7854=289,529856 Area of the gr.

Alſo 16 ×16 ×,7854=201,0624 ditto leſſer Baſe

Sum of their Areas 490,592256

Again 289,529856×201,0624=58213,567719, whoſe ſquare Root=241,274; which added to 490,592256 =731,866256.

∵ $731,866256\times\frac{102,4}{3}=24981,034874546$ Conical

And 201,0624×51,2= 10294,39488 Cylinder.

Solid Content of the Pillar 35275,42975 Inches.

∵ 1728)35275,42975(20,41988 ſolid Feet, at 3*s.* 6*d.* or ,175£.

Then 20,41988×,175=3,573479 or 3£. 11*s.* $5\frac{1}{2}$*d.* Anſ.

Farther

16×3,1416=50,2656 Circumference of the Cylind.

19,2×3,1416=60,3187 ditto Baſe.

2)110,5843(55,29215

Then $\frac{19,2 \quad 16}{2 \quad 2}$ = 1,6, and 1,6 × 1,6 = 2,56

Alſo 102,4×102,4 = 10485,76

their Sum 10488,32

∵ $\sqrt{10488,32}$=102,4125 Slope Height.

Then

Then 102,412×55,29215 =5662,6534 Con. Superf.
Alſo 51,2×50,2656 = 2573,5987 Cylinder.
289,526 Bottom Area.
201,0624 Top ditto.

their Sum 8726,8405 Inches.

∵ 144)8726,8405(60,8 Feet, the Superficial Content.

(22) Firſt 19,5—13,5=6 Diff. of the Sides.
And 6×6=36,÷3=12 the $\frac{1}{3}$ of the ſq. of their Diff.
Now 16 ft. 6 inc.=198 Inches, the Length.
Then 19,5×13,5×12×198=5499,5 cubic Inches.
1728)5499,5(31,539 ſolid Feet, at 2*s.* 6*d.* or ,125£.
∵ 31,539×,125=3,942375 or 3£. 18*s.* 10*d.* the Anſw.

(23) Firſt 3,1416×26×26×2 = 4247,4432
Alſo 3,1416×20×20 = 1256,64

Sum 5504,0832

Then 5504,0832 × $\frac{100}{3}$ = 183469,44 cubic Inches, (per Prob. XXIX.)
∵ 282)183469,44(650½ Ale=2010½ Gal. nearly Bar. London Ale.
231)183469,44(794¼ Brandy. *Q. E. F.*

(24) Firſt 6 Feet=72 Inches.
Then 3,1416×72=226,19568, the Circumference.
And 226,19568 × 72=16286,0544 Inches, ſuperficial Content, (per Prob. XXIII.) at 3½*d.* per Inc.=237£. 10*s.* 1*d.* 2, nearly, the Anſwer.

(25) Firſt 21 × 21 × ,7854 = 346,3614, Area of the Baſe.
Then 346,3614×31=10737,2034 ſolid Feet.
∵ 10737,2034×1728=18553887,4752 cubic Inches.
231)18553887,4752(80319,8 Gallons.
A Tun=Galls. 252)80319,8(318 Tuns, 183,8 Gallons, the Anſwer.

75. SPECIFIC GRAVITY of METALS.

CASE I.

(1) Thus $,03309446\times12096=400,3122816$ lb.
Adv. $\div112=3,5742+$ Cwt. the Anſwer.

(2) Firſt $\frac{20}{5}=4$. Alſo $4\times4=16$ ſqr. of $\frac{1}{5}$ Girth.
And 40 Feet $=480$ Inches.
Then $480\times2\times16=15360$ cubic Inches, (per Prob. XXVIII.) in Menſuration.
By Rule II. $,023763\times15360=356$ lb. nearly, or 3 Cwt. 29 lb. the Weight required.

(3) Firſt $7\times7\times7\times,5236=179,5948$ ſolid Inches, (per Prob. XXIV.)
Then $179,5948\times,2580647=46,347$ lb. the Anſwer.

(4) Firſt 2580647)42,0000000(162,75 the Solidity nearly.
Then ,5236)162.75(310,828877 Cube of the Diameter, (by Prob. XXIV.)
$\because\ \sqrt[3]{310,828877}=6,77$, the Diameter required.

(5) Firſt $16-6=10$, Diameter of the Concavity.
Then $16\times16\times16\times,5236=2144,6656$ Cont. of the whole.
And $10\times10\times10\times,5236=\ \ 523,6$ Cont of the Concavity, (per Prob. XXIV.)
Solidity of the Shell $=1621,0656$ Inches.

$\because\ 1621,0656\times,2580647=418,3398$ lb. the Weight req.

(6) Firſt $76+5=81$, the greater Diameter.
Alſo 3 ft. 4 inc. $=3,\dot{3}$ the greater Breadth.
$\because$ As $81:3,\dot{3}::76:3,127572$, its leaſt Breadth.

Here the Chords and their Arches being nearly equal, in ſo ſmall a Part of ſo large a Circle, differs very little from a right Line: the Figure of the Key-ſtone may be reckoned a Priſmoid, and meaſured accordingly. (See Prob. XXII.)

Now $3,\dot{3}\times4=13,\dot{3}$. And $3,127572\times4=12,510288$.
Alſo $6,460965\times8=51,68772$ which are the Numbers to be added.
Then $13,\dot{3}+12,510288+51,68772=7,531341\dot{3}$ Sum.
$\because\ 7,531341\dot{3}\times\frac{5}{6}=\frac{3876567}{6}=64,6094$ ſolid Feet.

Then

Then 64,6094×1728=111645 cubic Inches (nearly.)
∵ 111645÷,0929543=12017,4 lb.
Therefore a Ton = lb. 2240)12017,4(5,3649+ or 1 Ton. 5 cwt. 1 qr. 5lb. the Anſwer.

(7) Firſt 63×12×12=9072 ſolid Feet.
Then 9072×1728=15676416 cubic Inches.
∵ 15676416×,0977286=1532034,1887 lb.
∵ And 2240)1532034,1885(683 Tons, 18 cwt. 98lb. the Anſwer.

CASE II.

(8) Firſt 8 Tons 14 cwt.=19488 lb.
Then ,0977286)19488,0000000(199409,4 Inches.
Now 1728)199409,4(115,4 cubic Feet, at 6*s.* or ,3£.
Then 115,4×3=,34,62=34£. 12*s.* 4¾*d.* the Anſwer.

(9) Firſt 1300×4=5200 hhds. and 1 hhd.=282×54= 15228 cubic Inches.
∵ 15228×5200=79185600 cubic Inches, diſplaced.
Then 79185600×,037253=2949901 lb. Averd.
∵ 2240)2949901(1316 Tons, 18 cwt. 1 qr. 17 lb. the Weight required.

(16) Firſt 3×3=9 ſolid Inches, in the Gold Chain.
Then 9,962625×9=89,663 25 its Weight in Air.
And 0,527458×9= 4,747122 wt. of its Bulk of Water.

Weight of the Gold 84,916503 in Water, *Q. E. F.*

Now a ſolid Inch of Silver=5,556769 oz. Troy.
Then as 5,556769 : 1 :: 14,5 : 2,6094 inc. of Silver.
∵ 89,663(625—14,5=75,163625 oz. of Gold.
And 9,962625)75,163625(7,54456 Space taken up by the [Gold.
2,6094 dit. of Silver.

Sum 10,154 by both.
9, ditto of Gold.
1,514 ditto of Silver.

∵ 9)1,154,128 ⅔ inc. higher. *Q. E. F.*

(11)

(11) Firſt 1036)63,00(6,08108, had it been Gold.
Alſo 5,85)63,00(10,76923, if all Silver.
Then by Sect XXIX.

$$8,2245 \left\{ \begin{matrix} 6,08108 \\ 10,76923 \end{matrix} \right\} \left\{ \begin{matrix} 2,54473 \\ 2,14342 \end{matrix} \right.$$

Sum 4,68815

4,68815)2,54473(,5428, Part Gold, per *oz.*
4,68815)2,14342(,4572, Part Silver.

$$\text{Then} \left\{ \begin{matrix} ,5428 \\ ,4572 \end{matrix} \right\} \times 63 = \left\{ \begin{matrix} 341884 = 34 & 3 & 22\frac{1}{4} & \text{Gold.} \\ 28,8036 = 28 & 16 & 1\frac{3}{4} & \text{Silver.} \end{matrix} \right.$$

oz. dwts. gr.

76. CHRONOLOGY.

(1) Thus, 1795÷4=448 and 3 remains, ſo it is the 3d Year after Leap Year.

(2) Thus, 1796÷4=449 and 0 remains, ſo it is Leap Year.

(3) 4)1795
448
7)2243
320—3 Remains.
∵ 7—3=4=D.
So D is the Dominical Letter.

(4) 4)1796
449
7)2245
320—5 Remains.
∵ 7—5=2=B.
So C B are the Dominical Letters.

(5) The Dominical Letter (by the laſt Prob.) is D. And per the Verſe, the 1ſt of May is B, viz. on Friday. Then B 1, B 8, B 15, C 16, D 17, E 18, F 19; ſo the 19th of May happens on Tueſday.

(6) The Dominical Letter is B, (per Ex. IV.) and per Verſe, the 1ſt of June is E, viz. on Wedneſday. Then E 1, F 2, G 3, A 4; conſequently the 4th of June muſt be on Saturday.

(7) 1795
9
28)1804

1795
1
19)1796

1795
3
15)1798

Rem. ſol. Cyc. =12 lun. Cyc.=10 Indiction=13

$$\begin{array}{ccc} 1796 & 1796 & 1766 \\ 9 & 1 & 8 \\ \hline 28)1797(64 & 19)1789(94 & 15)1791(119 \\ \hline \end{array}$$

Rem. ſol. Cyc. $=3$ lun. Cyc. $=11$ Indiction $=14$

So that 12 and 3 are the ſolar Cycles, 10 and 11 the lunar Cycles or Golden Numb. and 12 and 14 the Indic Cyc.

(8) The Golden Number is 10 (per laſt Ex.)
Then $11\times10=110$ which $\div30=3$, and 20 remains.
$\because 20-11=9$ the Epact.

(9) The Golden Number is 11, then $11\times11=121$, which $\div30=4$ and 1 remains. $\therefore 19+1=20$, the Epact.

(10) The Epact is 9, (per Ex. VIII) Number of the Month 3, and Day of the Month 21.
Then $9+3+21=33$, and $33-30=3$, the Moon's Age.
Alſo $30-3=27$ after 21ſt of May, or June 17th, the Day of the next new Moon.

(11) The Epact 20, (per Ex. 9) the Number of the Month 1, and Day of the Month is 24.
Then $20+1+24=45$.
$\because 45-30=25$ Days is the Moon's Age.
Now $30-25=5$ Days after the 24th of March, or the 29th of March is the Day of the next new Moon.

(12) The Dominical Letter is D, (per Prob. IV.)
On the 20th of March the Moon's Age is 30, (by Prob. VI.) ſo that the neareſt new Moon to March 20th falls on Feb. 12, and the 15th Day of that Moon is Feb. 18.
Now March 1ſt is D, or Sunday, (per the two Lines Prob. III.) Then Eaſter Sunday will be on the 5th of April.

(13) The Dominical Letter is B.
And on the 21ſt of March the Moon's Ags is 22, ſo that the neareſt new Moon to Match the 21ſt falls on Mar. 11th, and the 15th Day of that Moon is March 16th.
Now March 1ſt is D, conſequently Eaſter Sunday will be on the 27th of Match; from which the other moveable Feaſts may be found.

Or by knowing what Day of the Month Shrove Sunday is on, all the reſt may be found.

Shrove Sunday is always the firſt Sunday after the ſecond Change of the Moon, which happeneth after New-Years Day: and if that Day of the ſecond Change be Sunday, then that Sunday is Shrove Sunday.

EXAMPLE.

What Day of the Month is Shrove Sunday in the Year 1786, being Feb. 24th.

Firſt the Moon's Age is 14 Days old*, (per Prob. VI.)

Then by running back, I find the Day of her ſecond Change will be Feb. 10th.

Now by the Lines in Prob. III. the firſt of Feb. is D, or Wedneſdry, as the Dominical Letter is A, (per Prob. II.)

Therefore D being the firſt, D is 8, E 9, F 10, G 11, A 12; ſo that Shrove Sunday will be on Feb. 26th, being the firſt Sunday after the ſecond Change.

Now Shrove Sunday being found as above, Feb. 26th.

Quadrageſima, or the firſt Sunday in Lent, muſt be	April 5.
Eaſter Day, being 7 Weeks after Shrove-Sunday, muſt be	April 16.
Eaſter Term, beginning a Fortnight after Eaſter Wedneſday, muſt be	May 3.
Rogation Sunday, being 6 Weeks after Eaſter Wedneſday, muſt be	May 21.
Aſcenſion Day, being 39 Days after Eaſter muſt be	May 25.
Eaſter Term, ends the Monday after Aſcenſion Day,	May 29.
Whit Sunday, is 7 Weeks after Eaſter, muſt be	June 4.
Trinity Sunday, the next after Whit Sunday, muſt be	June 11.

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* In this Caſe the Epact muſt always be uſed for the Year before; as it is for 1786, uſe the Epact for 1785, which is 18, (per Prov. V.)

Trinity Term, begins Friday after Trinity-Sunday. } June 16.

Trinity Term, ends Wedneſday Fortnight afterwards. } July 3.

And the Beginning and End of Hillary, and Michaelmas Terms are fixed.

Note, the Septuageſima is a Fortnight, and Sexageſima a Week before Shrove Sunday.

Advent Sunday, is always that Sunday next the 30th of November, whether before or after it.

Epiphany is reckoned among the moveable Feaſts; but it is always the 6th of January.

(14) 3 Moon's Age.
4
5)12
2 hrs. 24 m. after Midday.

(15) 25 Moon's Age.
4
5)100
20
12
8 h. after Midnight

		h.	m.
(16)	Per Ex. IV. the Moon ſouths at	2	24 p. m. D.
	At London ☽ bears N. E. or S. E.	3	0
	Sum	5	24

Anſwer 24 Min. paſt 5 at Night.

		h.	m.
(17)	The Moon ſouths at	8	af. M. N.
	At Briſtol Key ☽ bears E. by S. and W. by N.	6	45
	Sum	14	45

Anſwer 45 Min. paſt 2 M.

QUESTIONS.

(1) In the Reign of William I. were 5 intercalary Days, (by Prob. I.)

Between Sept. 9. and Oct. 4. are 25 Days.

And 1087 | 1066=21 yrs. wanting 25 Days.

Then 21 ×365+5−25=1645 Days, William I. reigned.

In the Reign of William Rufus were 4 intercalary Days.
Between Auguſt 9, and Sept. 9, are 38 Days.
And 1000—1087=13 yrs. all but 38 Days.
Then 365×13—38+4=4711 Days, William II. reigned.
Laſtly, in the Reign of William III. were 3 intercalary Days.
From Feb. 3, to March 8, are 33 Days.
And 1701—1689=12 Years, and 33 Days.
Then 365×12+33+3=4416 Days, Will. III. reigned.

(2) In the Reign of Richard I. were 2 intercalary Days.
Between April 6, and July 7, are 92 Days.
And 1399—1189=10 yrs. wanting 92 Days.
Then 365×10+2—92=3560 Days, Richard I. reigned.
In the Reign of Richard II. were 5 intercalary Days.
From June 21, to Sept. 30, are 101 Days.
And 1399—1377=22 Years and 101 Days he reigned.
Then 365×22+101+5=8136 Days, Rich. II. reigned.
In the Reign of Richard III. was 1 intercalary Day.
From June 18, to Auguſt 22, are 65 Days.
And 1485—1483=2 yrs. and 65 Days he reigned.
Then 365×2+65+1=796 Days, Richard III. reigned.
Therefore 3560+8136+796=12492 Days, the Anſwer.

(3) In the Reign of Queen Mary, were only 1 intercalary Day.
But from 1553 till 1602, were 12 intercalary Days.
So that in the Reign of Q. Elizabeth, were 11 intercalary Days.
From July 8, to Nov. being 4 mo. 9d. are 132 Days.
Then 365×5+132+1=1958 Days, Mary reigned.
Now 1602—1553=49 Years.
And from March 14, to July 8, are 115 Days.
Alſo 365—115=250 Days.
Then 365×49+250+12=18147 Days, to the Beginning of James's Reign.
∵ 18147—1958=16189 Days, Elizabeth reigned.
In the Reign of James I. were 6 intercalary Days.
From March 14, to the 27th is 13 Days.
And 1625—1602=23 Years, but the Date altering at our Lady Day, ſo that the intercal. was only 22 Years.
Therefore 365×22+13+6=8049 Days James I. reigned.

In the Reign of Charles I. were 6 intercalary Days.
From March 27, to Jan. 30, are 309 Days.
And 1648—1625=23 Years.

Then 365×23+309+6=8710 Days Charles I reigned.
∵ 16189+8049+8710=32948 Days the Anſwer.

(4) The Grant begun Decemb. 14th, 1109, and reſumed Nov. 19th. 1219.
From Nov. 19, to Dec. 14, are 25 Days.
And 1219—1109=100 Years, wanting 25 Days.
In which Time are 27 intercalary Days.

Then 365×110+27—25=40152 Days, the firſt Continuance.
The ſecond Grant revived July 16th, 1497, and ended May 10th, 1524
Then from May 10, to July 16, are 67 Days.
And 1524—1497=27 Years, wanting 67 Days, in which Time there are 7 intercalary Days.

Therefore 365×27+7—67=9795 Days, laſt in Force.
∵ 40152+9795=49947 Days, the Grant was in Force.
The firſt Grant reſumed Nov. 19th, 1219, and revived July 16th, 1498.
From Nov. 19, to July 16, are 239 Days.
And 365—239=126 Days.
Alſo 1498—1219=279 Years, wanting 126 Days; in which Period are 69 intercalary Days.

Therefore 365×279+69—126=101778 Days, ſuperſeded. *Q. E. F.*

77. GEOGRAPHY.

(1) Lat. 39° 54″ N. 57 S. and Long. 11 6°. 28 E.
(2) Jamaica and Cape of Good Hope.
(3) Diff. 10° 30′ and 48″.
(4) 4691¼ Miles, Buda, in Hungary, Madrid, &c.
(5) Decl. 19° 15′N. Right Aſc. 60° 45′, Mer. Alt. 57° 15′.
(6) R. 20′ P. 4, ſets 37′ P. 7, Amp. 30° N. Twil. beg. 21′ P. 1, ends 30′ P. 10.
(7) Azm. 78° from the N. Alt. 12° 30′.
(8) Port Royal bears W. from London, and London bears N. E. from Port Royal.

(9) 30′ P. 7, P. M. at Pekin, Breakfaſt at Port Royal, Dinner at Rome, and Supper at the Ladrone Iſles.
(10) Antigua, Pagan, one of the Ladrone Iſles, &c.
(11) May 10th, and Sept. 2d.
(12) All thoſe Places whoſe Lat is equal to 72° 45′ N.
(13) Begins May 4th, and leaves them Aug. 9th, following.
(14) Riſing to N. Mexico, Ter. Fuego, &c. ſetting to Candy in the Iſle of Ceylon, and Part of Aſia, &c. Noon at Porto, St. Vincent, &c.
(16) Begin in N. and S. America, the S. and Pacific Seas, Part of Tartary, the Land of Jeſſo, &c. Mid. All the great S. Sea, the E. and W. Indies, Part of Aſia, &c. End all Aſia, and the Eaſt Indies, New Holland, the S. Sea, Part of N. America, &c.
(17) 63°, (nearly.)
(18) Antoeci, Part of the S. Ocean, Peri, Part of the great Pacific Ocean, Antip. Part of New Zealand, or Part of the S. Ocean.
(19) Sun's Declination 23°.
(20) Sun's Place 21.30. ♉. Right Aſcenſion 29° E.
(21) Riſes 5½. Sets 6½. Amp. 5° N.
(22) Altitude 44° 30′. Azimuth 43 E.
(23) Hour 7½. Azimuth 76½.
(24) Courſe 60°. Diſtance ſailed 41°. 2460 Miles.
(25) Diff. of Long. 40°. Diſtance ſailed 63°. or 3780 Miles.
(26) Diff. of Long. 18°. Courſe 41°.
(27) Diff. of Lat. 23° 30′. Diſtance ſailed 39°. or 2340 M.
(28) Diff. of Lat. 29° 30. Long. 19°.

CELESTIAL GLOBE.

(1) At ¾ p. 3, ſets 20′ p. 4, no Night.
(2, 3, 4) For theſe Examples, the beſt will be to anſwer them for the Year you are in; as you will then (by the Ephemeries) have it in your Power to find the Node of the Moon, and her Place at Noon, likewiſe the Places of any of the Planets.
(5) Decl. 29° N. Right Aſc. 112, Lat. 6° 30′, Long 90° 45 Leo.
(6) Aldabaan riſes at 1 A. M. ſets at 4 P. M. comes to the Mer. ¾ p. 8, Amp. 26°. N.

(7) R. coſmically Sept. 24th, ſets July 6th.
(8) R. acronically Jan. 25th, ſets December 18th.
(9) Jan. 13th.
(10) Nov. 16th.
(11) Obl. Decl. 120°, continues above the Horiz. 9 hrs.
(12) Azim. 10°, from the N. Alt. 8°.
(13) ¾ p. 8.
(14) 14° 30′ N.
(15) 7′ p. 12.
(16) ¼ p. 3. A. M.
(17) Lat. 44° 30′ N.
(18) Lat. 22° 30′ N.
(19) 44° 30′ S.
(20) Arctures on the Mer. nearly, Canis Minor ſetting, and the Stars Lyra, Altayr, Cor Hydræ, Cor Leonis, Caſtr. Cappella, &c. will be viſible.
(21) Lat 3° 30′, Long. 26° 36′ of ♒, and Lat. 25° S. Long. 12° 30′ ♍.
(22) R. 3 h. 45 m. A. M. Amp. 14°, ſet 2 h. 25 m. P. M. Decl. 9° 15′ S. Right Aſc. 227° 30′.
(23) Through the Tail of Capricorn, the Head of Indus, the Neck and Body of Pavo, the Neck of Apus, Tail of Centaurus, between the two Stars in the Back of Hydra, and then to the Ecliptic near Cor Leonis: Velocity 4° ⅙ per Day.

ALGEBRA.

78. ADDITION.

EXAMPLES.

	(1)	(2)
To	$6a+7b-3c$	$ab-6b+4x+10y-15z+6$
Add	$10a+b-7c$	$6ab-b+x+4y-9z+3$
Sum	$16a+8b-10c$	$7ab-7b+5x+14y-24z+9$

	(3)	(4)
To	$-6b-7c-8x$	$6a-6x+7y-10$
Add	$4b+9c+5x$	$-6a+6x-4y+13$
Sum	$-2b+2c-3x$	$* \quad * \; 3y+3$

	(5)	(6)
To	$4a+6b+4c-6$	$2a-6bc$
	$4x-7y+4z$	$6x+10$
Sum	$4a+6b+4c-6+4x-7y+4z$	$2a-6bc+6x+10$

	(7)	(8)	(9)
To	$10a\sqrt{bc}$	$a\sqrt{bb+cc}$	$b+3\sqrt{aa-u}$
Add	$6a\sqrt{bc}$	$4a\sqrt{bb+cc}$	$b-3\sqrt{aa-u}$
Sum	$16a\sqrt{bc}$	$5a\sqrt{bb+cc}$	$2b \; * \quad *$

80. SUBTRACTION.

EXAMPLES.

	(1)	(2)	(3)
From	$3a$	$2a-4x+7y-7$	$6b-4c+4x$
Take	$-3a$	$6a+4x+7y+4$	$7b+7c-9x$
Rem.	$6a$	$-4a-8x \; * \; -11$	$-b-11c+13x$

	(4)	(5)	(6)
From	$10a\sqrt{bc}$	$6b\sqrt{aa+xx}$	$a+b$
Take	$6a\sqrt{bc}$	$4b\sqrt{aa+xx}$	$a-\sqrt{cc-aa}$
Rem.	$4a\sqrt{bc}$	$2b\sqrt{aa+xx}$	$*\,b+\sqrt{cc-aa}$

81. MULTIPLICATION.

EXAMPLES *in* CASE I.

$$\begin{array}{llll} & (1) & (2) & (3) \\ \text{Mul.} & a+c & -a-b-c & x+y+z \\ \text{by} & b & -d & a \\ \hline \text{Prod.} & ab+bc & ad+bd+dc & ax+ay+az \\ \hline \end{array}$$

$$\begin{array}{lll} & (4) & (5) \\ \text{Mul.} & -8x & 12x+6y \\ \text{by} & -4a & 4a \\ \hline \text{Prod.} & 32ax & 48ax+24ay \\ \hline \end{array}$$

$$\begin{array}{lll} & (6) & (7) \\ \text{Mul.} & -6d & 4x-5y+z \\ \text{by} & 7b & -6f \\ \hline \text{Prod.} & -42bd & -24fx+30fy-6fz \\ \hline \end{array}$$

$$\begin{array}{lll} & (8) & (9) \\ \text{Mul.} & 2a-4b & aa+ab+bb \\ \text{by} & 2a+4b & a-b \\ \hline & 4aa-8ab & aaa+aab+abb \\ & \quad +8ab-16bb & \quad -aab-abb-bbb \\ \hline \text{Prod.} & 4aa \quad * \quad -16bb & aaa \quad * \quad * \quad -bbb \\ \hline \end{array}$$

$$\begin{array}{ll} (10) \quad \text{Mul.} & xx-ax \\ \text{by} & a+x \\ \hline & axx-aax \\ & \quad xxx-axx \\ \hline \text{Prod.} & xxx-aax \quad * \\ \hline \end{array}$$

(11) Mul. $xx+xy+yy$
by $xx-xy+yy$

$$\begin{array}{r}x^4+x^3y+x^2y^2\\ -x^3y-x^2y^2+xy^3\\ x^2y^2+xy^3+y^4\\ \hline \end{array}$$

Prod. $x^4 \ast +x^2y^2y + \ast y^4$

(12)

M. $aaa-3aab+3ab^2-bbb$
by $aa-2ab+bb$

$$\begin{array}{l}a\ -3a^4b+3a^3b^2-\ a^2b^3\\ \quad -2a^4b+6a^3b^2-6a^2b^3+2a\,b^4\\ \qquad\qquad a^3b^2-3a^2b^3+3a\,b^4-b^5\\ \hline \end{array}$$

P. $a^5-5a^4b+9a^3b^2-a^2b^3\,10+5ab^4-b^5$

	(13)	(14)	(15)
Mul.	$\sqrt{bc+dcc}$	$\sqrt{xx+zz}$	$6cd\sqrt{b+ad}$
by	$\sqrt{ac}$	$\sqrt{xx-zz}$	$3a\ \sqrt{ca}$
Prod.	$\sqrt{abcc+adccc}$	$\sqrt{x^4-z^4}$	$18acd\sqrt{abc-aadc}$

82. DIVISION.

EXAMPLES in CASE I.

(1) $d)ad+6d(a+6$ (2) $-d)-ad-bd(a+b$

(3) $a)aa+ab(a+b$ (4) $-a)ab(-b$

(5) $b)-ab-bd(-a-d$

(6) $-bc)abc+bcd+bcf(-a-d-f$

(7) $7b)42db(6d$ (8) $2bx)8abx-18bxc(4a-9c$

(9) $2b+bb=\frac{ab-bb}{2b}=\frac{c-b}{a}$, here Unity, or $1b$ is the common Meaſure. (See Sect. XXXVIII. Caſe. I.)

(10) $20a)10ab+15ac(=\frac{10ab+15ac}{20a}=\frac{2b+3c}{4a}$, here 5 is the common Meaſure.

(11) $a-b)aaa-3aab+3abb-bbb(aa-2ab+bb$

$aaa-aab$

$* \ -2aab+3abb$

$-2aab+2abb$

$* \ abb-bbb$

$abb-bbb$

$* \ *$

(12) $a+b)aa+2ab+bb(a+b$

$aa+ab$

$* \ ab+bb$

$ab+bb$

$* \ *$

(13) $a+b)aa-bb(a-b$

$aa+ab$

$* \ -ab-bb$

$ab-bb$

$* \ *$

(14) $3a-6)6a^4-96(2a^3+4a^2+8a+16$

$6a^4-12a^3$

$* \ 12a^3-96$

$12a^3-24a^2$

$* \ * \ 24a^2-96$

$24a^2-48a$

$* \ 48a-96$

$48a-96$

$* \ *$

It often happens that the Operation may be continued without End, as in the laſt Example, and then you have an infinite Series for the Quotient; but by comparing the firſt three or four Terms you may find what Law the Terms obſerve: by which Means, without any more Diviſor, you may continue the Quotient as far as you pleaſe.

Thus, the laſt Example may be continued as far as you pleaſe, by adding the Power of *a*.

(15)

$$3x^2-4x+5)\,18x^4-45x^3+82x^2-67x+40\,(6x^2-7x-8$$
$$18x^4-24x^3+30x^2$$
$$*\ -21x^3+52x^2-67x$$
$$-21x^3-28x^2-35x$$
$$*\ -24x^2-32x+40$$
$$-24x^2-32x+40$$
$$*\quad *\quad *$$

(16)

$$4x-5a)\,48x^3-76rx^2-54a^2x+105a^3\,(12x^2-4ax-21a^2$$
$$48x^3-60ax^2$$
$$*\ -16ax^2-64a^2x$$
$$-16ax^2+20a^2x$$
$$*\ -84a^2x+105a^3$$
$$-84a^2x+105a^3$$
$$*\quad *\quad *$$

(17)

$$3x+4a)81x^4 * * -256a^4(27x^2-36ax^2+48a^2x-64a^3$$

$$81x^4+108ax^3$$

$$* -108ax^3$$

$$108ax^3-144a^2x$$

$$* \quad 144a^2x$$

$$144a^2x+192a^3x$$

$$-192a^3x-256a^4$$

$$192a^3x-256a^4$$

$$* \quad *$$

(18)

$$2x-3a)16x^4 * -72a^2x^2 * +81a^4(8x^3+12ax^2-18x^2a-27a^3$$

$$16x^4-24ax^3$$

$$* -24ax^3-72a^2x^2$$

$$24ax^3-36a^2x^2$$

$$* \quad 36a^2x^2 \quad *$$

$$36a^2x^2+54a^3x$$

$$* \quad -54a^3x+81a^4$$

$$54a^3x+81a^4$$

$$* \quad *$$

(19) $2xy\sqrt{z})4xy\sqrt{xzz}(2\sqrt{xz}$ the Quotient.

(20) $20\sqrt{2cy})60ab\sqrt{10acxy}(3ab\sqrt{5ax}$ the Quotient.

(21) $x^2)x^5(x^3$ the Quotient.

(22) $\overline{a+x}^4)\overline{a+x}^{11}(\overline{a+x}^7$ the Quotient.

83. FRACTIONS.

(1) Thus $a-x+\frac{a^2-ax}{x}=\frac{ax-xx+a^2+ax}{x}=$

$\frac{a^2-x^2}{x}$(by Sect. XXXVIII. Case III.

(2) Thus $a+b+\frac{x}{z}=\frac{az+bz+x}{z}$.

(3) Thus $a-x+\frac{aa-ax}{x}=\frac{ax-xx+aa-ax}{x}=$ $\frac{aa-xx}{x}$.

(4) Thus $\frac{a^2-x^2}{x}=-x+\frac{a^2}{x}$.

(5) Thus $\frac{az+bz+x}{z}=a+b+\frac{x}{z}$.

(6) Thus $\frac{ax-xx+aa-ax}{x}=-x+\frac{aa}{x}$.

(7) Thus $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}, =\frac{adf}{baf}, \frac{cbf}{bdf}, \& \frac{edb}{baf}$.

(8) Thus $\frac{b+c}{a+b}$ and $\frac{d-c}{b-d}=\frac{bb-bd+cb-cd}{ab-ad+bb-bd}$ and $\frac{ad-ac+bd-bc}{ab-ad+bb-bd}$

(9) First

$$a^2+ab+b^2)a^3+*-ab^2(a$$
$$a^3+2a^2b+ab^2$$

Rem. $-2a^2b-2ab^2)a^2+2ab+b^2(-\frac{1}{2b}\ \frac{1}{2a}$

$$a^2+ab$$
$$ab+b^2$$
$$ab+b^2$$
$$*\ *$$

Hence it appears that $-2a^2b-2ab^2$, is the common Measure; by which a^3-2b^2 being divided.

viz. $-2a^2-2b^2)a^3-*-ab^2(\frac{b}{2b}.\frac{1}{\times 2}$

$$a^3+{}^2ab$$
$$-a^2b-ab^2$$
$$2ab-ab^2$$
$$*\ *$$

Then $\frac{a}{2b}+\frac{1}{2}=\frac{-a+b}{2ba}$, the new Numerator.

And $\frac{1}{2b}-\frac{1}{2a}=\frac{-a-b}{2ba}$, the Denominator.

Let both be × $2ba$, and we ſhall have $\frac{-a+b}{-a-b}$ New N. / Deno.

Or change the Signs of all the Quantities, it will be $\frac{a^2-ab}{a+b}$, the new Fraction required.

That is $\frac{a^2-ab}{a+b}=\frac{a^3-ab^2}{a^2+2ab+b^2}$, the common Meaſure.

(10) Thus $\frac{25az}{5xz+15az}=\frac{5a}{x+3a}$, by expunging z, and dividing by 5.

Alſo $\frac{a^3+b^3}{a^2-a^2}=\frac{a^2-ab+b^2}{a-b}$, by dividing by $a+b$, the common Meaſure.

ADDITION.

EXAMPLES.

(1) Thus $\frac{a}{b}+\frac{c}{d}+\frac{d}{e}=\frac{ade+bce+ddb}{bde}$, the Sum.

(2) Thus $\frac{a-b+d}{d+a}+\frac{a+b-d}{d+a}=\frac{2a}{a+d}$, their Sum.

(3) Thus $\frac{2a-b}{a+c}+\frac{2b-a}{a+c}=\frac{a+b}{c+a}$, the Sum.

(4) Thus $\frac{a+b}{d}+\frac{2a+c}{d}=\frac{3a+b+c}{d}$, the Sum.

SUBTRACTION.

EXAMPLES.

(1) Thus $\frac{x}{2}-\frac{x}{3}=\frac{3x}{6}-\frac{2x}{6}=\frac{x}{6}$, the Difference.

(2) Thus $\frac{a+x}{b}-\frac{a-x}{c}=\frac{ac+ex}{bc}-\frac{ab-bx}{bc}=\frac{ac+cx-ab+bx}{bc}$, the Difference.

(3) Thus $\frac{b^2+a^2}{c}-\frac{b^2}{c}=\frac{a^2}{c}$, the Difference.

(4) Thus $\frac{2b}{a+d}-\frac{a+b-d}{a+d}=\frac{b-a+d}{a+d}$, the Diff.

MULTIPLICATION.

EXAMPLES.

(1) Thus $\frac{a+b}{c}\times\frac{a-b}{d}=\frac{a^2-b^2}{cd}$, the Product.

(2) Thus $a+\frac{b}{c}\times\frac{d}{c}=\frac{ca+b}{c}\times\frac{d}{c}=\frac{acd+bd}{cc}$, the Product.

(3) Thus $\frac{3a-2b}{2d+c}\times\frac{4a+2b}{d}=\frac{12a^2-2ab-4b^2}{2dd-dc}$, the Product.

(4) Thus $2a+\frac{b}{c}-25\times 36+4c=\frac{2ac+b-25c}{c}\times\frac{36+4c}{1}=\frac{6bac+3b^2-75bc+8ac^2+4bc-100c^2}{c}=$ $6ba-71b-8ac-100c+\frac{3be^2}{c}$, the Product.

DIVISION.

EXAMPLES.

(1) Thus $\frac{acd+bd}{cd}\div\frac{d}{e}=\frac{acde+bde}{cdd}$, or $\frac{ac+be}{cd}$, the Quotient.

(2) Thus $\frac{a-b}{a}\div\frac{a+b}{a-b}=\frac{a^2-2ab+b^2}{a^2+ba}$, the Quot.

(3) Thus $\overline{a+\frac{b}{c}}\div\overline{d+\frac{e}{f}}=\frac{ac-b}{c}\div\frac{fd+e}{f}=\frac{fa-bf}{fac+ce}$, the Quotient.

(4) Thus $\frac{ab}{c}\div\frac{1}{c}=ab$, the Quotient.

70. INVOLUTION.

(1) Thus the fourth Power of $x=x^4$.

(2) The fifth Power of $\overline{ax+z}|^2=\overline{ax+z}|^{10}$.

(3) The third Power of $3x^3z^2=27x^9z^6$.

(4) The fixth Power of $\frac{5ab}{2c}=\frac{15625ab^6}{64c}$,

(5) Thus

$$\begin{array}{l}
a+b \\
a+b \\
\hline
aa+ab \\
\quad ab+bb \\
\hline
a^2+2ab+b2\text{, the Square, or fecond Power.} \\
a+b \\
\hline
a^3+2a^2b+ab^2 \\
\quad a2b+2ab^2+b3 \\
\hline
a3+3a^2b+3ab^2+b3=\text{ the Cube, or third Power,} \\
a+b \\
\hline
a^4+3a^3b+3a2b^2+ab^3 \\
\quad a^3b+3a2b^2+3ab^3+b^4 \\
\hline
a^4+4a^3b+6a^2b^2+4ab^3+b^4\text{, the fourth Power.} \\
a+b \\
\hline
a^5+4a^2b+6a^3b^2+4a^2b^3+ab^4 \\
\quad a^4b+4a^3b^2+6a^2b^3+4ab^4+b^5 \\
\hline
a^5\,5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5\text{, the fifth Power.}
\end{array}$$

$a+b$

$a^6+5a^5b+10a^4b^2+10a^3b^3+5a^2b^4+ab^5$

$ab+5a^4b^2+10a^3b^3+10a^2b^4+5a^5b+b^6$

$a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab5+b^6=$ 6thP.

(6) Thus

$a-b$

$a-b$

a^2-ab

$ab+b^2$

$a^2-2ab+b^2$, ſecond Power.

$a-b$

$a^3-2a^2b+ab^2$

$-a^2b+2ab^2-b^3$

$a^3-3a^2b+3ab^2-b^3$, third Term.

$a-b$

$a^4-3a^3b+3a^2b^2-ab^3$

$a^3b+3a^2b^2-3ab^3+b^4$

$a^4-4a^3b+6a^2b^2-4ab^3+b^4$, fourth Power.

$a-b$

$a-4a^4b+6a^3b^2-4a^2b^3+ab^4$

$-a^4b+4a^3b^2-6a^2b^3+4ab^4-b^5$

$a^9-5a^4b+10a^3b^2-10a^2b^3+5ab^4-b^5$, fifth Power.

$a-b$

$a^6-5a^5b+10a^4b^2-10a^3b^3+5a^2b^4-ab^5$

$-a^5b+5a^4b^2-10a^3b^3+10a^2b^4-ab^5$

$a^6-a^5b+15a^4b-20a^3b^3+15a^2b^4-6ab^5+b^6=$ 6th P.

Theſe Examples are performed by the Theorem as follows: Here, *m*, Index of the propoſed Power, being 6; the firſt Term *am*, or the general Expreſſion is equal to a^6; the ſecond $ma^{m-1}b=6a^5b$; the third $\frac{m}{1}\times\frac{m-1}{2}\times a^{m-2}b=15a^4b^2$; the fourth $\frac{m}{1}\times\frac{m-1}{2}\times\frac{m-2}{3}\times a^{m-3}b=20a^3b^3$; the fifth $\frac{m}{1}\times\frac{m-1}{2}\times\frac{m2}{3}\times\frac{m-3}{4}\times a^{m-4}b=15a^2b^4$; the ſixth $\frac{m}{1}\times\frac{m-1}{2}\times\frac{m-2}{3}\times\frac{m-3}{4}\times\frac{m-}{5}\times a^{m-5}b=6ab^5$; the ſeventh $\frac{m}{1}\times\frac{m-1}{2}\times\frac{m-2}{3}\times\frac{m-3}{4}\times\frac{m-4}{5}\times\frac{m-5}{6}\times a^{m-6}b=b^6$; and the eighth $\frac{m}{1}\times\frac{m-1}{2}\times\frac{m-2}{3}\times\frac{m-3}{4}\times\frac{m-4}{5}\times\frac{m-5}{6}\times\frac{m-6}{7}\times a^{m-7}b=$ nothing.

Therefore the ſixth Power of $a+b=a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab^5+b^6$, as before.

71. EVOLUTION.

(1) $x^2+2xy+y^2(x+y$, the Root required.

$1x)2xy$

$x^2+2xy+y^2=$ ſecond Power of $x+y$

* * *

Or thus by Sect. 52.

$x^2+2xy+y^2(x+y$ Root as before.

x^2

$2x+y)$ * $2xy+y^2$

$2xy+y^2$

* *

(2) $x^2-2xy+y^2(x-y$, the Root.

x^2

$2x-y$ * $-2xy+y^2$

$-2xy+y^2$

* *

(3) $4^4-2x^3y+3x^2y^2-2xy^3+y^4(x^2-xy+y^2$, theRt.

4^4

$2x^2-xy)\ *\ -2x^3y+3x^2y^2$
$\quad -2xy+\ x^2y^2$

$2x^2-2xy+y^2)\ *\ \ 2x^2y^2-2xy^3+y^4$
$\quad 2x^2y^2-2xy^3+y^4$

$*\quad *\quad *$

(4) $x^2-6x^2y+12xy^2+8y^3\,(x-2y,$ the Root.
$3x^2)\quad 6x^2y$

$x^3-6x^2y+12xy^2+8y^3$

$*\quad *\quad *\quad *$

(5) $16x^4-96x^3y+216x^2y^2-216xy^3+81y^4\,(2x-3y,$ Rt.
$32x^3)\ *\quad 96\ {}^3y$

$16x^4-96x^3y+216x^2y^2-216xy^3-81y^4$

$*\quad *\quad *\quad *\quad *$

72. REDUCTION OF SIMPLE EQUATIONS.

(1) Given $20-3x-8=60-7x$.

Then by tranſpoſing $7x$, we ſhall have $4x+12=60$.

Therefore $x=\frac{60-12}{4}=\frac{48}{4}=12$.

For $\overline{20-12\times 3}-8=60-\overline{12\times 7}=-24$.

(2) Given $5x-16=3x+12$.

Here by tranſpoſing the $3x$ and 16 we get $2x=12+16$.

Therefore $x=\frac{12+16}{2}=\frac{28}{2}=14$.

For $\overline{14\times 5}-16=\overline{14\times 3}+12=54$.

(3) Given $\frac{3x}{4}+5=\frac{5x}{6}+2$.

Then (per Rule III) $18x+120=20x+48$.

Therefore $2x=72$, whence $x=72\div 2=36$.

For $\frac{36\times 3}{4}+5=\frac{36\times 5}{6}+2=32$.

(4) Given $\frac{7x}{8}-5=\frac{9x}{10}-8$.

Then $70x-400=72x-640$, whence $2x=240$, and $x=120$.

For $\frac{120\times7}{8}-5=\frac{120\times9}{10}-8=100.$

(5) Given $\frac{5x}{9}-8=74-\frac{7x}{12}.$

Then by multiplying both ſides of the Equation by 9, and 12, we ſhall have $60x-864=7992-63x.$

Therefore $123x=7992+864=8856$, and $x=8856\div123=72.$

(6) Given $56-\frac{3x}{4}=48-\frac{5x}{8}.$

Then $1792-24x=1536-20x.$

Therefore $4x=256$, and $x=256\div4=64$,

(7) Given $36-\frac{4x}{9}=8$

Then by multiplying both ſides of the Equation by 9, we have $324-4x=72.$

Therefore $4x=324-72=252.$

Therefore $x=252\div4=63.$

(8) Given $\frac{2x}{3}=\frac{176-4x}{5}.$

Then $10x=528-12x.$

And $22x=528.$

Therefore $x=528\div22=24.$

(9) Given $\frac{45}{2x+3}=\frac{57}{4x-5}.$

Then multiplying by $2\ x+3$, we ſhall have $45=$ $=\frac{114x+171}{4x-5}$; alſo multiplying by $4x-5$, we have $180x-225=114x+171$.

Therefore $180x-14x-225=171$, that is $66x=225=171.$

Therefore $66x=171+225$, that is $66x=396$, and $x=396\div66=6.$

(10) Given $\frac{42x}{x-2}=\frac{35x}{x+3}.$

Then by multiplying by $x-2$, and $x+3$, we get $42x^2-126x=35xx-70x.$

Therefore $42x^2-35x^2=126x-70x$, that is $7x^2=56x.$

Therefore by dividing by $7x$, we have $x=8$,

(11) Given $\frac{xx-12}{3}=\frac{xx-4}{4}.$

Then by multiplying both Sides of the Equation by 3, and 4, we have $4x^2-48=3x^2-12$.

Therefore $4x^2-3x^2=48-12$, that is $x^2=36$.

Whence $x=\sqrt[2]{36}=6$.

(12) Given $\frac{5xx}{16}=8+12$.

Then by multiplying by 16, we get $5x^2=20\times16=320$.

Therefore $x^2=320\div5-64$, and $x=\sqrt{64}=8$.

(13) Given $\frac{x+1}{2}+\frac{x+2}{3}=16-\frac{x+3}{4}$.

Then by multiplying by 2, 3, and 4, we get $12x+12+8x+16=384-6x-18$, that is $20x+28=366-6x$.

Therefore $20x+6x=366-28$, that is $26x=338$.

Whence $x=338\div26=13$.

(14) Given $ax+b^2=\frac{ax^2+ac^2}{a+x}$.

Then $\overline{ax+b^2}\times\overline{a+x}=ax^2+ac^2$, that is $a^2x+ab^2+ax^2+b^2x=ax^2+ac^2$.

Therefore $a^2x+b^2x=ac^2-ab^2$, and $x=\frac{ac^2-ab^2}{a^2+b^2}$.

(15) Given $\sqrt{\frac{5x}{3}}+12=17$.

Then $\sqrt{\frac{5x}{3}}=17-12=5$, and $\sqrt{5\,x}=5\times3=15$.

Therefore (by Rule IV.) $5x=225$, and $x=225\div5=45$.

(16) Given $\sqrt{12+x}=2+\sqrt{x}$, then (by Rule IV.) $12+x=4+4\sqrt{x}+x$.

Whence by Tranſpoſition $4\sqrt{x}=8$, and by Diviſion $\sqrt{x}-2$, conſequently $x=4$.

(17) Given $\sqrt{x}+\sqrt{a+x}=\sqrt{\frac{2a}{a+x}}$.

Then $\sqrt{ax+xx}+a+x=2a$, or $\sqrt{ax+xx}=a-x$.

Whence $ax+x^2=a^2-2ax+x^2$,

Therefore $3ax=a^2$.

$\therefore x=\frac{a^2}{3}$.

(18) Given $615x-7x^3=48x$.

Then by Tranſpoſition $615x-48x=7x^3$, that is $7x^3=567x$.

Whence divided by $7x$, we get $x^2=81$.

$\because x=9$.

(19) Given $\sqrt{a^2+x^2}=\sqrt{b^4+x^4}$.

Then by raiſing both Sides to the fourth Power, we have $\overline{ac^2+xx}|^2=b^4+x^4$, that is $a^4+2a^2x^2+x^4=b^4+x^4$.

Therefore $2a^2x^2=b^4-a^2$.

$$\therefore x^2=\frac{b^4-a^4}{2a^4}=\frac{b^4}{a^4}-a^2.$$

88. OF THE EXTERMINATION OF UNKNOWN QUANTITIES; OR, THE REDUCTION OF TWO OR MORE EQUATIONS, TO A SINGLE ONE.

(1) Given $\begin{cases}5x+8y=106\\4x-5y=5\end{cases}$

Here by multiplying the firſt Equation by 4, and the ſecond by 5, in order that the Coefficients of x, may be the ſame in both, there ariſes.

$$\begin{aligned}25x+32y&=434\\20x-25y&=25\end{aligned}$$

By ſubtracting the latter from the former we have $57y=399$.

Hence $y=\frac{399}{57}=7$.

And ſo by the firſt Equation $x=\frac{5+5\times7}{4}=\frac{40}{4}=10$.

(2) Given $\begin{cases}5x-3y=150\\10x+15y=825.\end{cases}$

Here the firſt Equation being multiplied by 2, (in order that the Coefficients of x, in both Equations, may be the ſame) we have $10x-6y=300$. Let this Equation be ſubtracted from the ſecond, and we ſhall have $21y=525$.

Hence $y=\frac{525}{21}=25$.

Therefore by the firſt Equation $x=\frac{150+25+3}{5}=\frac{225}{5}=45$.

$$\text{(3) Given}\begin{cases}\frac{x}{2}+\frac{y}{3}+\frac{z}{4}=62\\[4pt]\frac{x}{3}+\frac{y}{4}+\frac{z}{5}=47\\[4pt]\frac{x}{4}+\frac{y}{5}+\frac{z}{6}=38\end{cases}$$

Here the given Equations cleared of the Fractions, become

$$12x+8y+6z=1488$$
$$20x+15y+12z=2820$$
$$30x+24y+20z=4560$$

Now, to exterminate z, let the ſecond of theſe Equations be ſubtracted from the double of the firſt. And alſo, three Times the third, from four Times the ſecond. Whence is had

$$4x+y=156$$
$$10x+3y=420$$

Again, to exterminate y, from three Times the firſt take the ſecond, and we ſhall then have $12x-10x=468-420$. From which $x=\frac{48}{2}=24$.

Therefore $y=156-24\times4=60$.

And $z=\left(\frac{1488-8y-12x}{6}\right)=120$.

$$\text{(4) Given}\begin{cases}\frac{x}{4}+\frac{y}{5}=15\\[4pt]\frac{x}{6}+\frac{y}{9}=9\end{cases}$$

Here our Equations cleared of Fractions will be

$$5x+4y=300$$
$$9x+6y=486$$

And if from double of the latter we take triple of the former, we ſhall have $18x-15x=972-900$, that is $3x=72$.

Whence $x=\frac{72}{3}=24$.

And $y=\frac{300-5x}{4}=45$.

$$(5)\quad \text{Given}\begin{cases}\frac{x}{2}-12=\frac{y}{4}+8\\ \frac{x+y}{5}+\frac{x}{3}-8=\frac{2y-x}{4}+27\end{cases}$$

Here the Equations cleared of the Fractions we ſhall have

$$4x-96=2y+64$$

And $12x+12y+20x-480=30y-15x+1620$

Which contracted, become

$$4x-2y=64+96=160$$
$$47x-18y=2100$$

From the laſt of which ſubtract nine Times the former, and we have $41x-36x=2100-1440$, that is $11x=660$.

Hence $x=\frac{660}{11}=60$

And $y=\frac{4x-160}{2}=\frac{240-160}{2}=\frac{80}{2}=40$

$$(6)\quad \text{Given}\begin{cases}x+y=80\\ x+z=70\\ y+z=60\end{cases}$$

Here by ſubtracting the ſecond Equation from the firſt (in order to extirminate x) we have $y-z=10$, to which the third Equation being added, z will likewiſe be extirminated, there coming out $2y=70$, or $y=35$.

Whence $z=y-10=25$, and $x=80-y=35$.

$$(7)\quad \text{Given}\begin{cases}x+100=y+z\\ y+100=2x+2z\\ z+100=3x+3y\end{cases}$$

To the double of the firſt, let the ſecond Equation be added; ſo ſhall the x's, on the contrary Sides deſtroy each other, and we ſhall have $300+y=2y+4x$, or $y+4z=300$.

Moreover, to the triple of the firſt let the third Equation be added, whence will be had $z+400=6y+3z$, or $2z+6y=400$.

Now if from the double of this laſt Equation (which is $4z+12y=800$) the former (viz. $y+4z=300$) be ſubtracted, then will come out $11y=500$.

Therefore $y=\frac{500}{11}=45\frac{5}{11}$, and $z=\frac{300-y}{4}=75-\frac{y}{4}$ $=75-11\frac{4}{11}=63\frac{7}{11}$

And $x=y+z-100=109\frac{1}{11}-100=9\frac{1}{11}$

(8) Given $x-y=2$, and $xy+5x-6y=120$.

Then to exterminate x.

By the firſt Equation $x=2+y$; which Value being ſubſtituted in the laſt (according to Rule II.) it becomes $\overline{y+2}\times y+5\times\overline{y+2}-6y=120$, that is $y^2+2y+5y+10-6y=120$, or $y^2+y=110$.

(9) Given $\left\{\begin{array}{l} x+y=s \\ x^2-y^2=d \end{array}\right\}$ quere x and y.

Then $x=s-y$; the Square of which is $x^2=s^2-2sy+y^2$

Alſo ${}^2x=d+y^2$.

Therefore $d+y^2=s^2-2sy+y^2$.

Hence $d=s^2-2sy$.

And $2sy=s^2-d$.

So $y=\frac{s^2-d}{2s}$.

And $x=\frac{s^2+d}{2s}$.

(10) Given $\left\{\begin{array}{l} x+y+z=12 \\ x+2y+3z=20 \\ \frac{x}{3}+\frac{y}{2}+z=6 \end{array}\right\}$ To find x, y, and z.

Then we have $\left\{\begin{array}{l} 1.\ x=12-y-z \\ 2.\ x=20-2y-3z \\ 3.\ x=68-\frac{3}{4}y-3z \end{array}\right.$

From whence we have theſe two Equations $\left\{\begin{array}{l} 12-y-z=20-2y-3z \\ 12-y-z=18-\frac{3}{2}-3z \end{array}\right.$

Therefore we have (by Rule I.) $y=4-z=2$, and $x=6$.

Sometimes the Equations are ſuch, that the ſame Quantities in different Equations may have contrary Signs, and deſtroy each other; or to be otherwiſe affected, ſo as to ſhorten the common Proceſs very much.

Thus $\begin{cases} x+y+z=26 \\ x-y=4 \\ x-z=6 \end{cases}$

Then by Addition only, $3x=36$.

Hence $x=12$, $y=x-4=8$, and $z=x-6=6$.

104. QUADRATIC EQUATIONS.

(1) Given $x^2-4x=32$, to find the Value of x.

Here $x^2-4x+4=32+4=36$, (by Rule III.)

And $x-4=\sqrt{36}=6$, (by Rule IV.)

Therefore $x=6+2=8$.

(2) Given $12x^2-420x=1200$, to find x.

Here $x^2-35x=-200$, (by Rule II.)

And $x^2-35x+306,25=206,25$, (by Rule III.)

Alſo $x-17.5=\sqrt{209,25}=14,361406$, (by Rule IV.)

Therefore $x=31,861406$, or $3,138594$.

(3) Given $4x^2+60x=216$, to find x.

Here $x^2+15x=54$, (by Rule II.)

And $x^2+15x+56,25=110,25$.

Alſo $x+7,5=\sqrt{110,25}=10,5$.

Therefore $x=10,5-7,5=3$.

The fifteen following Equations, or Queſtions, are from Mr. WARD'S MATHEMATICAL GUIDE.

(1) Given $\begin{cases} a+e=s=240 \\ a-e=d=192 \end{cases}$ to find the reſt.

Here by Addition we get $2a=s+d$.

Therefore $a=\frac{s+d}{2}=\frac{240+192}{2}=\frac{432}{2}=216$.

Then by ſubtracting the ſecond Equation from the firſt we get $2e=s-d$.

And $e=\frac{s-d}{2}=\frac{240-192}{2}=\frac{48}{2}=24$.

Now as a and e are found, the reſt may be very eaſily found as follows:

$$ae=\frac{ss-dd}{4} \text{ or } 216\times24=5184=p.$$

$$\text{And } \frac{a}{e}=\frac{s+d}{s-d}, \text{ or } 216\div24=9=q.$$

$$\text{Alſo } a^2+e^2=\frac{s^2+{}^2d}{2}, \text{ or } 216\times216+24\times24=47232$$

$$=z.$$

$$\text{Likewiſe } a^2-e^2=sd, \text{ or } \overline{216\times216}-\overline{24\times24}=46080$$

$$=x.$$

(2) Given $\left\{\begin{array}{l} a+e=s=240 \\ ae\ \ =p=5184 \end{array}\right\}$ to find a, e, d, q, z, x.

Here by ſubtracting 4 Times the ſecond Equation from the Square of the firſt, we have $a^2-2ae+e^2=s^2-4p$.

Therefore $a-e=\sqrt{s^2-4\frac{1}{2}}=d$, Now by adding this Equation to the firſt we get $2a=s+\sqrt{\frac{s^2-4p}{2}}$.

$$\text{Hence } a=\frac{s+\sqrt{ss-1}}{2}=216.$$

And by ſubtracting we have $2e=s-\sqrt{ss-4p}$.

$$\text{Hence } e=\frac{s-\sqrt{s^2-4p}}{2}=24.$$

Therefore the reſt may be very eaſily found by proceeding as in the laſt Example.

(3) Given $\left\{\begin{array}{l} a+e=s=240 \\ \dfrac{a}{e}\ \ =q=9 \end{array}\right\}$ to find the reſt.

Here by ſubtracting the ſecond Equation from the firſt, we have $e=s-qe$,

Therefore $e=\frac{s}{q+1},=\frac{240}{10}=24$. Which taken from the firſt Equation gives $a=s-\frac{s}{q+1}=240-\frac{240}{9+1}=240-24=216$.

From hence the reſt may be very eaſily found.

(4)

(4) Given $\left\{\begin{array}{l} a+e=s=240 \\ a^2+e^2=z=47232 \end{array}\right\}$ to find the reſt.

Here from the Square of the firſt Equation take the ſecond, and we have $2ae=s2-z$. Which taken from the ſecond Equation gives $a-2ac+e2=2z-s^2$.

Therefore $a-=\sqrt{2z-s^2}=d$.

This added to the firſt Equation gives $2a=s+\sqrt{2z-s}$.

Hence $a=\dfrac{s+\sqrt{2z-2}}{2}=216$.

And ſubtracted gives $2e=s-\sqrt{2z-s^2}$.

Whence $e=\dfrac{s-\sqrt{2z-s^2}}{2}=24$.

(5) Given $\left\{\begin{array}{l} a+e=s=240 \\ a^2-e^2=x=46080 \end{array}\right\}$ to find the reſt.

Here the ſecond Equation divided by the firſt gives

$a-s=\dfrac{x}{s}=d$.

Which added to the firſt, we have $2a=s+\dfrac{x}{s}=\dfrac{s^2+x}{s}$.

Hence $a=\dfrac{s^2+x}{2s}=216$.

And the third ſubtracted from the firſt gives

$2e=s-\dfrac{x}{s}=\dfrac{s^2-x}{s}$.

Hence $e=\dfrac{s^2-x}{2s}=24$.

(6) Given $\left\{\begin{array}{l} a-e=d=192 \\ ae=p=5183 \end{array}\right\}$ to find the reſt.

Here to the Square of the firſt Equation add 4 Times the ſecond and we ſhall have $a^2+2ac+e^2={}^2d+4p$.

Therefore $a+e=\sqrt{aa+4p}=s$.

This Equation added to he firſt gives $2a=d+\sqrt{dd+4p}$.

Therefore $a=\dfrac{d+\sqrt{dd+4p}}{2}=216$.

Then by taking the firſt Equation from the fourth, we have $2e=\sqrt{dd\times 4p}-d$.

Hence $e=\frac{\sqrt{dd+4p}-d}{2}=24$.

(7) Given $\left\{\begin{array}{l} a-e=d=192 \\ \frac{a}{e}=q=\quad 9 \end{array}\right\}$ to find the reſt.

Here by tranſpoſing e in the firſt Equation, and multiplying the ſecond by e, we get $qe=d+e$.

Then $e=\frac{d}{q-1}=24$.

for $\overline{q-1}\times e=qe-e$. And by adding this laſt Equation to the firſt we have $a=d+\frac{d}{q-1}=216$.

(8) Given $\left\{\begin{array}{l} a-e=d=\quad 192 \\ a^2+e^2=z=47232 \end{array}\right\}$ to find the reſt.

Here by taking the Square of the firſt from the ſecond, we have $2ae=z-dd$. This added to the ſecond Equation gives $a^2+2ae+e^2=2z-dd$. Therefore $a+e=\sqrt{2z-dd}$. Which added to the firſt Equation gives $2a=d+\sqrt{2z-dd}$.

Therefore $a=\frac{d+\sqrt{2z-dd}}{2}=216$.

Then by taking the firſt Equation from the fifth we get $2e=\sqrt{2z-dd}-d$. Hence $e=\frac{\sqrt{2z-dd}-d}{2}$.

(9) Given $\left\{\begin{array}{l} a-e=d=\quad 192 \\ a^2-e^2=x=46080 \end{array}\right\}$ to find the reſt.

Here by dividing the ſecond Equation by the firſt, we have $a+e=\frac{x}{d}$. Then by adding this Equation to the firſt, we get $2a=d+\frac{x}{d}$. Hence $a=\frac{dd+x}{2d}$.

And by taking this Equation from the third, we have $a=\frac{x-dd}{2d}$.

10 Given $\left\{\begin{array}{l} ae=p=5184 \\ \frac{a}{e}=q=9 \end{array}\right\}$ To find the reſt,

Here by multiplying the two Equations together, we have $aa=qp$. For $\frac{ae}{4}\times\frac{a}{e}=\frac{aae}{e}=aa$. Then $a=\sqrt{qp}=216$.

And by dividing the firſt Equation by the ſecond, we ſhall have $ee=\frac{p}{q}$.

For $\frac{a}{1})\frac{ae}{1}(\frac{aee}{a}=ee$. Hence $e=\sqrt{\frac{p}{q}}=24$.

(11) Given $\left\{\begin{array}{l} ae=p=5184 \\ a^2+e^2=z=47232 \end{array}\right\}$ to find the reſt.

Here to the ſecond add twice the firſt, and we have $a^2+2ae+{}^2e=z+2p$.

Therefore $a+e=\sqrt{z+2p}=s$.

Then by taking twice the firſt Equation from the ſecond, we have $a^2-2ae+{}^2e=x-2p$.

Hence $a-e=\sqrt{z-2p}$. This Equation added to the fourth, gives $2a=\sqrt{z+2p}+\sqrt{z-2p}$.

Therefore $a=\frac{\sqrt{z+2p}+\sqrt{z-2p}}{2}=216$.

Then by taking the ſixth Equation from the fourth, we have $2e=\sqrt{z+2p}-\sqrt{z-2p}$.

Hence $e=\frac{\sqrt{z+2p}-\sqrt{z-2p}}{2}=24$.

(12) Given $\left\{\begin{array}{l} ae=p=5184 \\ a^2-{}^2e=x=46380 \end{array}\right\}$ to find the reſt.

Here to the Square of the ſecond Equation add 4 Times the Square of the firſt, and we ſhall have $a^4+2a^2c^2+e^4=xx+4p^2$. Hence $a^2+e^2=\sqrt{x^2+4p}=z$.

This Equation added to the ſecond will give $2a^2=x+\sqrt{x^2+4p^2}$. Whence $a=\sqrt{x+\sqrt{x^2+4p^2}}=216$.

Then by ſubtracting the ſecond Equation from the fourth, we have $2e^2=\sqrt{x^2+4p^2}-x$.

Hence $e=\sqrt{:\frac{\sqrt{x^2+4p^2}-x}{2}}=24$.

(13) Given $\left\{\begin{matrix}\frac{a}{e} = q = 9 \\ a^2+e^2=z=47232\end{matrix}\right\}$ to find the reſt.

Here from the ſecond Equation take the Square of the firſt, and we ſhall have $ee=z-qqee$, or $qqee+ee=z$.

Hence $ee=\frac{z}{qq+1}$. For $\overline{qq+1}\times ee=qqee+ee$. Therefore $e=\sqrt{\frac{z}{qq+1}}=24$.

Then by taking this laſt Equation from the ſecond we have $aa=z-\frac{z}{qq+1}=\frac{qqz}{qq+1}$. Hence $a=\sqrt{\frac{qqz}{qq+1}}=216$.

(14) Given $\left\{\begin{matrix}\frac{a}{e} = q = 9 \\ aa-ee=x=46080\end{matrix}\right\}$ to find the reſt.

Here by comparing the firſt when multiplied by e, and ſquared with the ſecond more ee, we have $qqee=x+ee$, or $qqee-ee=x$.

Hence $ee=\frac{x}{qq-1}$

Therefore $e=\sqrt{\frac{x}{qq-1}}=24$

Then by adding the fourth Equation to the ſecond, we get $aa=x+\frac{x}{qq-1}=\frac{qqx}{qq-1}$. Hence $a=\sqrt{\frac{qqx}{qq-1}}$

(15) Given $\left\{\begin{array}{l} aa+ee=z=47232 \\ aa-ee=x=46080 \end{array}\right\}$ to find the reſt.

Here by Addition (only) we have $2aa=x+z$.

Hence $a=\sqrt{\frac{x+z}{2}}$

Then by ſubtracting the ſecond Equation from the firſt, we get $2ee=z-x$.

Therefore $e=\sqrt{\frac{2-x}{2}}$.

The Reaſon of my proceeding (only) with the firſt Queſtion throughout, is being confined, not having Room; but I hope this will not be the Pupil's Caſe.

PROBLEMS.

(1) Here let $x=$ the greater Number.
Then $x-20=$the leſſer.
Which added together gives $2x-20=70$
Therefore $2x=70+20=90$.
And $x=90\div 2=45$, the greater Number.
$\because$ $45-20=25$, the leſſer.
For $45-25=20$.
And $45+25=70$.

(2) Here let $x=$the greater Number.
Then $x-14=$the leſſer.

Therefore by the Queſt. $\frac{x}{x-14}=3$.

Hence $x=3x-42$, and $2x=42$.
$\because$ $x=42\div 2=21$, the greater Number.
Likewiſe $21-14=7$, the leſſer.
For $2-7=14$.
Alſo $21\div 7=3$.

(3) Suppoſe x to be the Number.

Then by the Queſt. $\frac{x}{3}+\frac{x}{4}=21$.

Therefore $7x=252$.
Hence $x=36$, the Number required.

For $\frac{36}{3}+\frac{36}{4}=12+9=21$.

(4)

(4) Let x be the Number.

Then per Queſt. $\frac{x}{3}-\frac{x}{4}=4$.

Hence $x=48$, the Number required.

For $\frac{48}{3}-\frac{48}{4}=16-12=4$.

(5) Suppoſe $x=$the Number required.

Then per Queſt. $\frac{x}{3}-4=\frac{x}{4}-,25$.

Hence $4x-48=3x-3$.

Therefore by Tranſpoſition $x=45$.

For $\frac{45}{3}-4=\frac{45}{4}-,25=15-4=11,25-,25$.

(6) Let x repreſent the greater, and $x-8$ the leſſer Number.

Then per Queſt. $16x-64=208$.

Hence $16x=272$, and $x=17$, the greater.

Alſo $17-8=9$, the leſſer Number.

For $17-9=8$, the Difference.

And $17\times17-9\times9=289-81=208$.

The above Queſtion may be ſolved by making uſe of two Letters, ſee Mr. WARD's 9th Queſtion.

(7) Let $x=$the greater Number, and y the leſſer.

Then by the Queſt. we ſhall have $x+y=60$.

And as $x : y :: 9 : 3$.

Therefore $9y=3x$, or $9y-3x=0$.

To which add the firſt Equation multiplied by 3, and we ſhall have $12y=180$.

$\therefore y=15$, the leſſer Number.

And $60-15=45$, the greater.

For $45+15=60$.

And as $45 : 15 :: 9 : 3$.

(8) Her let $x=$ the greater Number. and y the leſſer.

Then per Queſt. $xy=108$.

And $\frac{3x}{y}=4$.

Therefore by deſtroying x, we ſhall have $\frac{108}{y}=\frac{4y}{3}$.

Hence $4y^2=324$, and $y^2=81$.
$\therefore y=9$, the leſſer Number.

And $\dfrac{108}{9}=12$, the greater.
For $12\times9=108$.
Alſo $\dfrac{12\times3}{9}=\dfrac{36}{9}=4$.

(9) Let $x=$ the greater Number, and y the leſſer.
Then by the Queſtion we ſhall have

$$1.\quad x+y+8=2x$$

$$2.\quad x-y-4{,}5=\frac{y}{2}$$

Then by multiplying the ſecond Equation by 2, we get $2x-2y-9=y$.
And by the firſt Equation $x=y+8$.
Which ſubſtituted for x in the laſt Equation, we ſhall have $y=7$, the leſſer Number.
Then $x=7+8=15$, the greater.
For $15+7+8=15\times2=30$.

Alſo $15-7-4{,}5=\dfrac{7}{2}=3{,}5$.

(10) For the Number ſought, put x, y, and z.
Then by the Queſtion we ſhall have

$$\left.\begin{aligned}1.\quad & x+\frac{y+z}{2}=\\ 2.\quad & y+\frac{x+z}{3}=\\ 3.\quad & z+\frac{x+y}{4}=\end{aligned}\right\}34=a.$$

Then by clearing the Equations of the Fractions, we get

$$\begin{aligned}4.\quad & 2x+y+z=2a\\ 5.\quad & 3y+x+z=3a\\ 6.\quad & 4z+x+y=4a\end{aligned}$$

Now (to extirminate z) let the fourth Equation be ſubtracted from the fifth; alſo the ſixth from four Times the fifth, whence is had

$$\begin{aligned}7.\quad & 2y-x=a\\ 8.\quad & 11y+3x=8a\end{aligned}$$

From which we have $2y-a=\dfrac{8a-11y}{3}$.

Therefore $17y=11a=314$.

Hence $y=\frac{314}{17}=22$.

Then by the ſeventh, $x=44-34=10$.

Alſo by the fourth, $z=68-42=26$.

For $10+\frac{22+26}{2}=34$

And $22+\frac{10+26}{3}=34$.

Alſo $26+\frac{10+22}{4}=34$.

(11) Let $3x=$the major Part of the firſt Diviſion.

Then $100-3x=$ the minor Part.

And by the Queſtion we ſhall have $x=$the minor Part of the ſecond Diviſion.

Alſo $100-x=$ the major Part.

Whence by the Queſtion $100-x=200-6x$.

Hence $x=\frac{100}{5}=20$, the minor Part of the 2d Diviſion.

And $100-20=80$, the major Part.

$$\left.\begin{array}{l}\text{Again } 20\times3=60,\text{ major}\\ \text{And } 100-60=40,\text{ minor}\end{array}\right\}\text{Part of firſt Diviſion.}$$

For $60=20\times3$, and $80=40,\times2$.

(12) Let x repreſent A's Contribution.

$$\left.\begin{array}{l}\text{Then } x+10=\text{B's.}\\ \text{And } 2x+10=\text{C's.}\end{array}\right\}\text{by the Queſtion.}$$

Therefore $4x+20=76$.

Hence $x=\frac{76-20}{4}=14$ A's.

And $14+10=24$ B's.

Alſo $14\times2+10=38$£. C's Contribution.

(13) Let $x=$the Length.

Then $52-x=$ the Breadth.

Now $52x-xx=480$, per Queſtion.

Therefore $xx-52x=-480$.

And $xx-52x+676=676-480=196$.

$\because x-26=14$.

Hence $x=40$ in Length.

And $52-40=12$, in Breadth.

This Queſtion may be ſolved by making uſe of two Letters. See Mr. WARD's ſecond Queſtion.

(14) Suppoſe $x=$ the Quantity ſold at 12*d.* per lb.

Then as $\frac{3}{4}:\frac{2}{3}::x:\frac{8x}{9}=$ the other at 15*d.* per lb.

Therefore by multiplying each Quantity by its Price, we have $12x+\frac{40x}{3}=19\times12=228$.

Hence $36x+40x=684$.

From which $x=\frac{684}{76}=9$lb. at 1*s.* and $\frac{8x}{9}=8$lb. at 1*s.* 3*d.* per lb.

For as $9:8::\frac{1}{4}$ to $\frac{2}{9}$.

(15) Suppoſe he had x Guineas.

Then by the Queſt. $x-\frac{x}{4}+\frac{x}{5}=66$.

$\therefore 20x-9x=1320$.

Hence $11x=1320$.

And $x=120$ Guineas, had at firſt.

(16) Let $x=$ the greater, and y the leſſer Number.

$$\left.\begin{array}{l}\text{Then } xx+xy=77\\ \text{And } \quad xy-yy=12\end{array}\right\}\text{ by the Queſtion.}$$

Now by deſtroying xy, we get the following Equation,

$77-xx=12+yy$.

Hence $xx=65-yy$.

$\therefore x=\sqrt{65-yy}$.

Then by ſubſtituting this for x, in the ſecond Equation we have $y\sqrt{65-yy}-yy=12$.

Or $\sqrt{65-yy}=\frac{12+yy}{y}$.

Then by ſquaring each Side, $65-yy=\frac{144+24y^2+{}^4}{y^2}$.

Or $2y^4-41y^2=-144$.

Therefore by $\div2$, we have $y^4-20{,}5y^2=-72$.

And by completing the Square, we get $y^4-20{,}5\;{}^2$

$105{,}0625=33{,}0625$.

Or $y^2-10{,}25=\sqrt{33{,}0625}=5{,}75$.

Then $y^2=16$.

Hence $y=4$, and $65-16=49=x^2$.

Therefore $x=7$.

(17) Let $x=$ the Number required.

Then by the Queſt. $4xx-40x+100-1=7x$.

Or $4x^2-47x=-99$.

Therefore by $\div 4$, we have $x^2-11,75x=-24,75$.

Or $x^2-11,75x+34,515625=9,765625$.

$\because x-55,875=\sqrt{9,765625}=3,125$.

Hence $x=3,125+5,875=9$, the Number required.

For $9\times2-10=8$.

Alſo $8\times8-1=9\times7=63$.

(18) Here let $x=$ his Part, and y her's.

Then $\left\{\begin{array}{l}\frac{x}{5}=\frac{y}{4}+10\\ x+y=1000\end{array}\right\}$ by the Queſtion.

Therefore by deſtroying the x's we get $\frac{5y+200}{4}=1000-y$

Or $5y+200=4000-4y$.

$\left.\begin{array}{l}\text{Then } y=3800\div9=422\frac{2}{9}\text{ her}\\ \text{And } 1000-422\frac{2}{9}=577\frac{7}{9}\text{ his}\end{array}\right\}$ Share.

(19) Let $x=$ the leaſt Number.

Then we ſhall have x, $x+2$, $x+4$, and $x+6$, for the Numbers.

But $x\times\overline{x+2}\times\overline{x+4}\times\overline{x+6}=x^4+12x^3+44x^2+48x$.

Therefore $x^4+12x^3+44x^2+48x=945$, (by the Queſt.)

Wherefore $105x^2=945$. Hence $x^2=9$. And $x=3$, the leaſt.

Therefore the Numbers are 3, 5, 7, and 9.

(20) Put $x=$ his Age in Months.

Then $x+\frac{x}{2}+\frac{x}{8}-1=21\times21=441$, (by the Queſt.)

Or $16x+8x+2x-16=7056$. Or $26x=7072$.

Hence $x=\frac{7072}{26}=272$ m. or 22 yrs. 8 m. his Age.

For $272+\frac{272}{2}+\frac{272}{8}-1=21\times21=441$.

(21) Let x, y, and z, be the Numbers required.

Then per Queſt. $x-y=6$; or $y-6=x$; and $z-y=15$; or $z=15+y$.

But $x:y::y:z$; that is $y-6:y::y:15+y$.

Therefore $yy-90+9y=yy$. Hence $9y=90$. And $y=10$, the ſecond.

Then $10-6=4$, the firſt.

And $15+10=25$, the third Number.

(22) Suppoſe x to be the Number.

Then $x^6-19x^3=216$, (by the Queſt.)

Put $x^3=z, x^6=z^2$, and it will be $z^2-19z+\frac{361}{4}=216+\frac{361}{4}=\frac{1225}{4}$,

And $z-\frac{19}{2}=\pm\frac{35}{2}$. Whence $z=\frac{19\pm35}{2}=27$, or $=-8$. But $x=\sqrt[3]{z}$. Therefore $x=+3$, or -2.

(23) Let $x=$ the Length.

Then per Queſt. $3:2::x:\frac{2x}{3}=$ the Breadth.

Therefore $\frac{x\times2x}{3}=60000$, or $2xx=180000$.

Hence $xx=90000$. And $x=300$ Men in Rank.

Alſo $\frac{300\times2}{3}=200$ Men in File.

Now $\overline{300-1}\times2{,}75=822{,}25$ yds. Length.

And $\overline{200-1}\times2{,}75=547{,}25$ ditto Breadth.

4840)4499763125(92 ac. 3 rds. 35,2 p. the Ground they ſtand on.

(24) Put x the Side of the Square.

Then $xx+284=$ the whole Army.

And $x+1=$ the Number of Men deſigned for the Side of the Square.

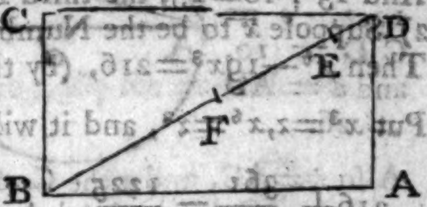
Conſequently $xx+2x+1-25=xx+284$. And by Tranſpoſition $2x=308$. Hence $x=154$ Men, the Side of the Square.

Wherefore $154\times154+284=24000$ Men, the whole Army required.

(25) Suppoſe $x=$ what he received.

Then per Queſt. $\frac{x-94}{2}+\frac{x-94}{5}+\frac{x}{10}+94=x$, This Equation cleared of the Fractions, we ſhall have $50x-4700+20x-1880+10x+9400=100x$ or $20x=2820$.

Hence $x=141$ £. the Sum required.

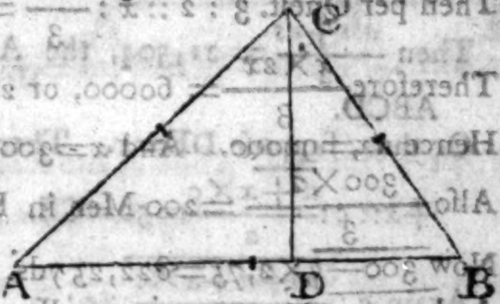


(26) Put $DF=9=a$, $DE=2=b$, and $x=AD=DB$. Then $DB=a+x$, and $AB=EB=a+x-b$. Therefore by the 47th of Euclid's firſt Book, we have $DB^2=AB^2+AD^2$, that is, $a^2+2ax+x^2=x^2+a^2+2ax-2ab+x^2-2bx+b^2$, or $x^2-2bx=2$

Then by Comp. the Square we get $x^2-2bx+b^2=2ab$.

Therefore $x-b=\sqrt{2ab}$. Hence $x=\sqrt{2ab}+b=\sqrt{2\times9\times2}+2=8=AD$, the Breadth.

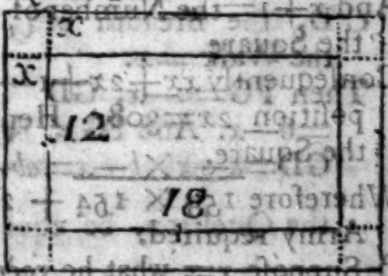
Alſo $9+8=17=AB$, the Length.



(27) Here $AB=15=a$, $AC=14=b$, $BC=13=c$, and $x=BD$, Then by the 47th of Book I. of Euclid, we ſhall have $AB^2-BD^2=AC^2-CD^2$. Or ${}^2-x^2=b^2-c^2+2cx-x^2$ that is $a=b^2-c^2+2cx$.

And by Tranſpoſition we get $2cx=a-b^2+c^2$. Hence $x=\frac{a^2-b^2+c^2}{2c}=\frac{169-196+225}{30}=\frac{198}{30}=6{,}6=BD$.

And $15-6{,}6=8{,}4=DA$. *Q. E. F.*



(28) Let x = the Breadth ſought.

$18+2x=$ Length AB or CD,

$12+2x=$ AD or BC.

Hence $4x^2+60x+216=18\times12\times2=432$. Or $4x^2+60x=432-216=216$.

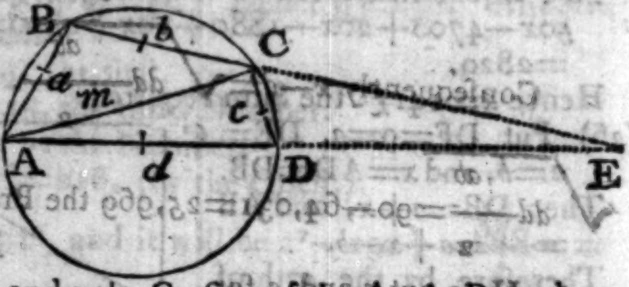
Which ÷ 4 gives $x^2+15x=54$.

Now by Comp. the Square, we have $x^2+15x+56{,}25=110{,}25$. Or $x+7{,}5=10{,}5$.

Therefore $x=10{,}5-7{,}5=3$, the Breadth required.

(29)

(29) Put $a =$ AB$=15{,}60$, $b =$ BC $= 13{,}2$, $c =$ CD $= 10$, and $d =$ AD $= 26$.



Alſo $m=$AC, and y the Co-ſine of the Angle D, and $-y$ = the Co-ſine of the Angle B.

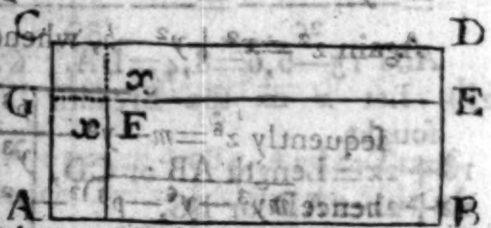
Then (per Theo. p. 12. in Mr. Ant. Tacker's Miscel.) we ſhall have $a^2+b^2+2ab=m^2$, and d^2+c^2-2cd. $\therefore a^2+b^2+2ab=d^2+c^2-2dc$. Hence $2aby+2dcy=\overline{a^2+c^2}\,\overline{-a^2-b^2}$. And $y=\frac{d^2+c^2-a^2-b^2}{2ab+2ac}$, whoſe Sine call s.

Then $\frac{abs+ds}{2}=21{,}504$, the Area of the Trapezium ABCD.

Or thus, ſuppoſe DE$=x$. Then by ſim. Triangles $a:\overline{d+x}::c:\frac{\overline{d+x}\times c}{a}=50=$CE. $\therefore$ BE$=\frac{\overline{ba+\overline{d+x}\times c}}{a}=$

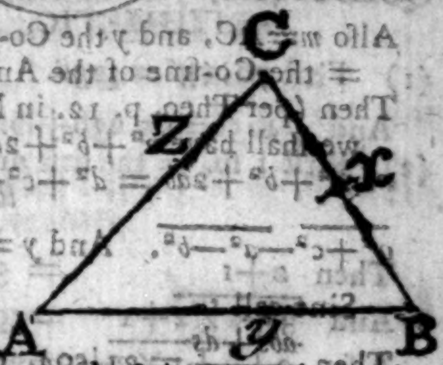
Again $a:\frac{\overline{ba+d+x\times c}}{a}::c:x$. Hence $x=\frac{\overline{ab+cd}\times c}{a^2-c^2}=32{,}5$. And the Area of the Trapezium ABCD$=21{,}504$ Acres as before (by Sect. 70. Prob. III. Rule III.)

(30) Put AB$=100=a$, BC $= 80 = b$, AF$=$CD, the Breadth of the Walk $=x$. Then FG$=a-x$, GD $=6-x$. And FG$\times$ GD$=\overline{a-x}\times\overline{b-x}=ab-ax-bx+x^2$, which muſt by the Queſtion, be equal to $\frac{ab}{2}$. Hence this Equation $ab-ax-bx+x^3=\frac{ab}{2}$. Put $2d=a+b$. Then $xx-2dx=\frac{ab}{2}$. Therefore $xx-2dx+da=dd-\frac{ab}{2}$.



Conſequently $x-d=\sqrt{dd-\frac{ab}{2}}$. Hence $x=d$ $\sqrt{dd-\frac{ab}{2}}=90-64{,}031=25{,}969$ the Breadth req.

(31) Here put s and c for the natural Sine and Coſide of the Angle ABC, Radius $=1$, a for the Area of the Triangle, m for the Sum of the Cubes of the Sides, and x, y, and z, for the Sides, as in the Figure.



Then we ſhall have $sxy=2a$, and $x^2+y^2=z^2+2cxy$ (per Trigonometry.)

Hence $xy=\frac{2a}{s}$ which call p, and $x^2+y^2=z^2+2cp$, for $2cp$ put b; then $x^2+y^2=z+b$.

Now $x=\frac{p}{y}$, $\therefore x^3=\frac{p^3}{y^3}$, and therefore the Equation $x^3+y^3+z^3=m$, as given by the Queſtion, becomes $\frac{p^3}{y^3}+y^3+z^3=m$, whence $z^3=m-y\frac{p^3}{y^3}$.

Again $z^2=x^2+y^2-b$, whence $z^2=\frac{p^2}{y^2}+y^2-b$, conſequently $z^6=\overline{m-y^3-\frac{p^3}{y^3}}\rceil^2$, and $z^6=\overline{\frac{p^2}{y^2}+y^2-l}\rceil^3$ hence $\overline{my^3-y^6-p^3}\rceil^2-\overline{p^2+y^4-by^2}\rceil^3$.

This Equation properly reduced will give $y=8$, from whence x is found to $=10$, and $z=6$, the Sides req.

Suppoſe the Sum of the Squares of the Sides had been given, inſtead of the Sum of the Cubes: then we ſhould have had $x^2+y^2+z^2=m$, and the other Equations as before, viz. $xy=p$, and $x^2+y^2=z^2+b$, hence z^2+b+ m; or $z=\sqrt{\frac{m-b}{2}}$, which being now known, put $z^2+b=n$, then $x^2+y^2=n$; but $xy=p$, therefore $x^2+2xy+y^2=n+2p$, and $x^2-2xy+y^2=n-2p$, conſequently $x+y=\sqrt{n+2p}$, and $x-y=\sqrt{n-2p}$; therefore $x=\sqrt{\frac{-n+2p+\sqrt{n-2p}}{2}}$.

QUESTIONS, ANSWERED (BOTH) BY COMMON ARITHMETIC, AND ALGEBRA.

(1) Firſt $76\times56=4256$.

And $\sqrt{4256}=65{,}238+$ lb. the true Weight required.

(2) Firſt 1 lb. = the firſt or leaſt Weight.

		lb.		
		1	firſt.	Weight.
Then	$2+1$	= 3	ſecond.	
And	$\overline{3+1}\times2+1$	= 9	third.	
Alſo	$\overline{9+3+1}\times2+1$	= 27	fourth.	
	Sum of which	= 40	the whole Weight.	

(3) Firſt 6s. ¼d. = 289 Farthings.

Then $\sqrt{289}=17$ Perſons. Or 17 qrs. = 4½d. what each ſpent.

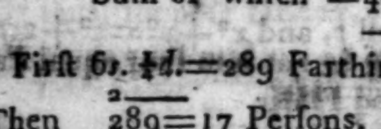
(4) Here $x=$ the Number of Spots. $n=7$, $r=12$, and $w=52$.

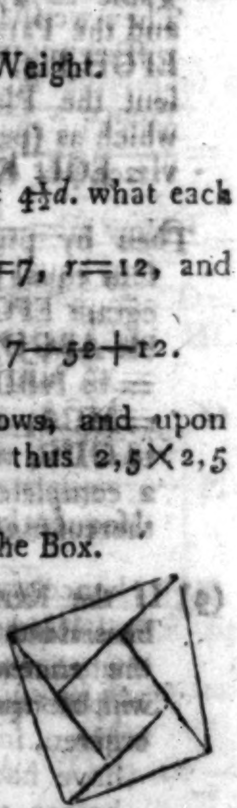
Then per Theo. $x=13\times n-w+r=13\times7-52+12$.

Therefore $x=103-52=51$ Spots.

(5) Suppoſing the Oranges to be laid in Rows, and upon each other; then the Solution will be thus $2{,}5\times2{,}5\times2{,}5\times2000=31250$.

$\because\ \sqrt[3]{31250}=31{,}498$ Inches, inſide of the Box.





(6) Let Fig. 1. repreſent the Plank as is to be cut, and the ſecond Fig. as they are placed to make the Square.

(7) The Hour-hand goes only $\frac{1}{12}$, the Circumference in an Hour, the other goes the whole, or $\frac{12}{12}=1$.

Then $\frac{12}{12}-\frac{1}{12}=\frac{11}{12}$, Minute-hand gains in an Hour.

Therefore as $\frac{11}{12}$ cir. : 1 h. or :: 1 cir. : $\frac{12}{11}$ h. $=1$ h. $5\frac{5}{11}$ m.

∵ 1 h. $5\frac{5}{11}\times 5=27\frac{3}{11}$ min. paſt 5, the Time required.

For when the Hands are in Oppoſition, the Minute muſt be $\frac{6}{11}$ a Head of the Hour-hand.

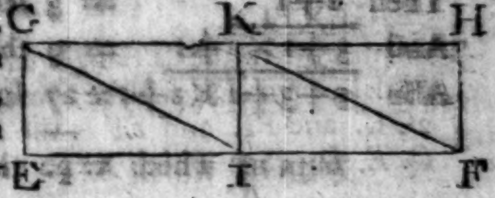
Hence as 11 : 1 h. or 60 min. :: 6 : $32\frac{8}{11}$ min. paſt 12.

And for the next Conjunction it will be as 11 : 1 h. : : $\overline{6\times 2}$ (12(: $=\frac{12}{11}=1$ h. $5\frac{5}{11}$ min. as above.

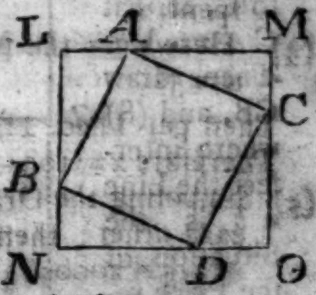
As 11 : 1 :: 12 + 12 (24) : $\frac{24}{11}=2$ h. 11 $\frac{9}{11}$ the next Conjunction.

Alſo as 11 : 1 h. : (12×5260) : $\frac{60}{11}=5$ h. 27 $\frac{3}{11}=27\frac{3}{11}$ min. paſt 5, the Anſwer as above.

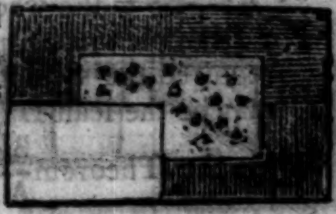
(8) Let ABCD, Fig. 2, represent the given Table = 27 Inches, and the Parallelogram EFGH Fig. 1. repreſent the Plank=4 ft. which as (per Queſt.) muſt be cut into four equal Parts, viz. EGI, KIG, IKE, and FHK.

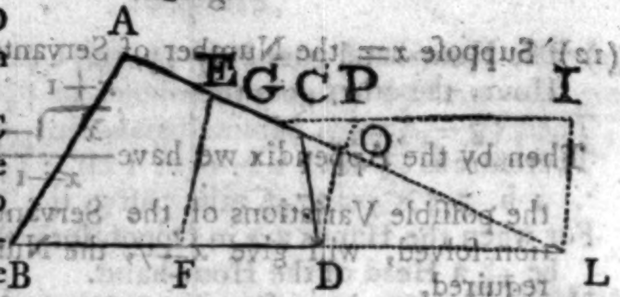


Then by properly applying the four equal Parts in the Parallelogram EFGH, to the given Table ABCD, then will EGI be = to NBD, KIG=LAB, IKF =MCA, and HFK will be = to ODC, which makes LMNO, a complete Square, each Side thereof=36 Inches, which was required.



(9) If the Remainder of the Land be divided into four Parts, as in the annexed Plan, theſe Parts will be equal and ſimilar to each other.

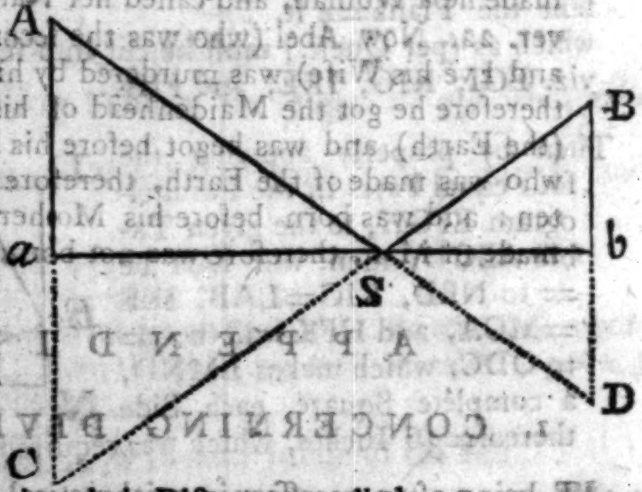




(10) Let ABCD be the given Trapezium, and let AC and B D be produced to L; then upon L, make the Parallelogram DPIL=the Triangle DCL + half the given Trapezium, and making the Angle LDO=LOD, produce I P to meet A L in G; then take E L, a mean Proportional between P I, and 2 G L, and draw E F parallel to PD, ſo will EF be the Line required.

Demonſtration, from the Similiarity of Triangles, we have $\frac{1}{2}GL\times\overline{LI : GL}|^{2} :: PI\times\overline{LI:EL}|^{2}$, conſequently $\overline{EL}|^{2} = 2GL\times PI$.

Therefore when the Triangle LEF = the Parallelogram PDLI, then EL will be a mean Proportional between 2GL, and PI, and EF is the ſhorteſt Line poſſible. *Q. E. D.* (See Theo. X. p. 112 of Simpson's Geom.)



(11) Thus let the Line *Aa* be continued to C, ſo that C*a* = A*a*. Then draw CB, and (S) where interſect the Line *ab* is the Situation of the Place required.

∴ AS+BS= the whole Diſtance travelled.

For Example thus, ſuppoſe *ab*=50, A*a*=40, and B*b*=30, required the Situation of a Place S, ſo that SA+SB, may be the leaſt Diſtance poſſible.

Then the Theorem $\frac{Bb \times ab}{Aa + Bb}=Sb$, when AS + SB is the leaſt poſſible that is $\frac{130\times 50}{40+30}=\frac{1500}{70}=21,42857=$ S*b*. Therefore S*a*=28,57143.

(12)

(12) Suppoſe $x=$ the Number of Servants.

Then by the Appendix we have $\dfrac{\left.\overline{\dfrac{x+1}{x}}\right| - x}{x-1} = 960799$, all the poſſible Variations of the Servants; which Equation ſolved, will give $x=7$, the Number of Servants required.

GENEALOGICAL PARADOXES.

(1) Lot committing Inceſt with his two Daughters, and having by each of them a Son, produced that Paradoxical Relation of the Sons to each other; for by that Means, Lot became, at the ſame Time, their Father, and Grand-father; and they were Brothers, and firſt Couſins to each other; alſo each Mother was Aunt to the other's Son. See Gen. xix. ver. 31, to the End.

(2) The Lord God formed the firſt Man, Adam, of the Duſt of the Ground; Gen. ii. ver. 7, and from Adam made he a Woman, and called her Name Eve. Gen. ii. ver. 22. Now Abel (who was the ſecond Son of Adam and Eve his Wife) was murdered by his Brother Cain; therefore he got the Maidenhead of his Grandmother (the Earth) and was begot before his Father (Adam) who was made of the Earth, therefore was not begotten: and was born before his Mother (Eve) who was made of Man, therefore was not born.

APPENDIX.

1. CONCERNING DIVISORS.

IT being often neceſſary in arithmetical Calculations, to find ſuch Multipliers, or Numbers, which may be divided by any Number of given Diviſors, without any Remainder, or Remainders; by which Means many pleaſant Queſtions, not reducible to any other Rule in common Arithmetic, may be ſolved.

To find the leaſt Number that can be divided by any Number of Diviſors with a Remainder.

RULE.

Multiply all the Prime * Numbers, and the Root of ſuch as are Square or Cube Numbers, continually; the Product will be the Number required.

EXAMPLES.

(1) Required the three leaſt Numbers, which divided by 20 ſhall leave 19 for a Remainder; but, if divided by 19, ſhall leave 18; if divided by 18 ſhall leave 17; and ſo on, always leaving one leſs than the Diviſor, to Unity.

G. DIARY, 1747.

By Algebra thus, ſuppoſe $x=$ the leaſt Number poſſible. And let a, b, c, d, &c. repreſents the Quotients reſpectively produced by dividing x, by 2, 3, 4, 5, &c. Then will the Remainders be 1, 2, 3, 4, &c. Hence $x=2a+1=3b+2=4c+3=5d+4$, &c. to $20A+19$.

Now $a=b+\frac{b+1}{2}$. Hence $\frac{b+1}{2}=m\ a$, a whole Number.

$\because\ b=2m-1$, and $a=3m-1$.

Again $c=m-1+\frac{m}{2}$. Hence $\frac{m}{2}=n$, a whole Num.

And therefore $m=2n$, $c=3n-1$, and proceeding in this Manner we get $A=11639628\ B-1$; hence the Number required $x=232792560\ B-1$, where B repreſents any whole poſitive Number; and when $B=1$, then the Number required $x=23279$.

The Number required $x=232792560-1 = 232792559$

2d. $\underline{232792560}\times 2-1 = 465585119$

3d. $\underline{232792560}\times 3-1 = 698377679$

And thus may be performed other Numbers ad infinitum.

Or thus by the Rule,

Firſt 1, 2, 3, 5, 7, 11, 13, 17, and 19, are prime Numbs.

Alſo $\sqrt[2]{4}=2$, $\sqrt[3]{8}=2$, $\sqrt[2]{9}=3$, and $\sqrt[3]{16}=2$, and all the reſt are compoſite Numbers.

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* A Prime Number, is ſuch a Number as cannot be produced by the multiplication of two, or more Integers.

$\because 1\times2\times3\times2\times5\times7\times2\times3\times11\times13\times2\times17\times19=$ 232792560, the leaſt number that can be divided by the given Diviſors without a remainder, as before.

(2) What's the leaſt Number that can be divided by the Nine Digits, without a Remainder.

LADIES DIARY, 1719.

Diviſors 1, 2, 3, 4, 5, 6, 7, 8, 9.

Now $\sqrt{4}=2$; 6 may be cancelled, being compoſed 2×3; and 3, 5, and 7 are Prime Numbers.

And $\sqrt[3]{8}=2$. Alſo $\sqrt[2]{9}=3$.

Then per Rule $1\times2\times3\times2\times5\times7\times2\times3=2520$.

(3) A Country Girl to Town did go,
Some Walnuts there to ſell;
A Gentleman ſhe chanc'd to meet,
And thus it her beſell;
My pretty Maid, ſays to her,
What Number have you here?
I can't tell, Sir, ſaid ſhe to him,
But this I'll make appear;
I told them o'er, ere I came out,
By ſix's, five's, four's, three's, two's;
And every Time I number'd them
One remained Overplus:
I told them o'er by ſeven's at laſt,
And there were no Remains:
If you can find the Number out,
Pray take it for your Pains.

Firſt the laſt Number that can be divided by 1, 2, 3, 4, 5, 6, without a Remainder, will be $1\times2\times3\times2\times5=60$, per Rule.

Then $60+1=61$, will leave 1, when $\div$ 2, 3, 4, 5, 6.

But $7)61(8$, and 5 Remains.

$$\left.\begin{array}{l}\text{Alſo } \overline{60\times2+1}=121\\ \overline{60\times3+1}=181\\ \overline{60\times4+1}=241\end{array}\right\}\text{None of which are diviſible by 7, without a Remainder.}$$

But $\overline{60\times5+1}=301$, is the leaſt Number which admits of the Conditions of the Queſtion.

Then to find the next leaſt Number which admits of the ſame Conditions, we ſhall find by proceeding as above) to be $\overline{60\times12+1}=721$.

Alſo 721—301=420, the common Difference of all the Numbers anſwering the Conditions of the Queſtion. ∴ 301, 721, 1141, 1561, &c. ad infinitum, will anſwer the Conditions of this Queſtion.

(4) To find the leaſt Number of Guineas, which being divided by 6, 5, 4, 3, and 1, reſpectively ſhall leave 5, 4, 3, 2, and 2, reſpectively remaining.

LADIES DIARY, 1748.

Firſt $1\times2\times3\times2\times5=60$, the leaſt Number; which will divide by 2, 3, 4, 5, and 6, as by the laſt Queſtion. ∴ $60-1=59$, *Q. E. F.*

2. COMBINATIONS.

Combinations of Quantities, is the Manner of finding how many different Ways they may be varied, being taken 1 and 1, 2 and 2, 3 and 3, &c. as the Number of Combination of three Quantities, viz. *a*, *b*, and *c*, viz. *ab*, *ac*, *bc*. If three Quantities are to be combined, and their Number is only three, as *a*, *b*, and *c*, then the Number of Combinations will be only one, viz. *abc*; and if there are four Quantities *a*, *b*, *c*, and *d*, and three to be taken, then the Combinations will be four, viz. *abc*, *abd*, *bcd*, *acd*; and if the Number of Quantities to be combined be called *q*, and *u*, the Number of them to be taken, then the Number of Combinations will be $\frac{q-u+1}{1}\times\frac{q-u+2}{2}\times\frac{q-u+3}{3}\times\frac{q-u+4}{4}\times\frac{q-u+5}{5}$, &c. For ſuppoſe the Number of Quantities to be combined be 6, and the Number of them taken be 4, then the Number of Combinations will be $\frac{6-4+1}{1}\times\frac{6-4+2}{2}\times\frac{6-4+3}{3}\times\frac{6-4+4}{4}=\frac{1}{1}\times\frac{4}{2}\times\frac{5}{3}\times\frac{6}{4}=15$. The Number of all the poſſible Combinations beginning from the Combination of every two, will be $2q-9-1$; as when the Number of Quantities be 5, then the Number of poſſible Combinations will be $2^5-6=26$. So that if *u* repreſents any Number of Quantities, then will $\frac{u^{u+1}-u}{u-1}$ expreſs the poſſible Number of all the Variation, as if $u=7$, then $\frac{7^{\overline{7\times 1}|}}{7-1}-7=\frac{5764801-7}{6}=\frac{5764794}{6}=960799$.

To find the different Combinations in any Number, or Quantities.

RULE.

Having placed the given Quantity by itſelf, decreaſe it gradually by an Unit, ſo often as there are Quantities in the Combination; placing one above another, with a Sign of Multiplication between them, which Numbers muſt be multiplied into one another for a dividend: then placing an Unit with the like Number of places, increaſing by Unity till you arrive at the Number to be continued; which multiply continually for a Diviſor, and the Quotient will be the Number of Combinations ſought.

EXAMPLES.

(1) How many different Ways may 11 Halfpence hurſled in a Hat turn up?

First as a Halfpenny has two Faces. $\therefore 2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2$, or $2^{11}=2048$, the different Combinations required.

Now to find the different Chances for any Number of Heads, or Tails, let a repreſent the Heads, and b the Tails; then by the Theorem in Page 328, we ſhall have $a^{11}+11a^{10}b+55a^9b^2+165a^8b^3+330a^7b^4+462a^6b^5+462a^5b^6+330a^4b^7+165a^3b^8+55a^2b^9+11ab^{10}+b^{11}$ are all the different Combinations or Ways 11 Halfpence can turn up, viz. $1+11+55+165+330+462+462+330+165+55+11+1=2048$, as before.

Here it is to be obſerved, that a^{11}, or all Heads, hath but one Way of turning up; the ſame for b^{11} Tails: but 10 Heads and 1 Tail, and the contrary, may come up 11 different Ways each. Alſo nine Heads and two Tails, or the contrary may each come up $\frac{11\times10}{2}=53$ different Ways. Likewiſe eight Heads and three Tails, or the contrary may come up $\frac{55\times9}{3}=165$ different Ways, &c.

It may be alſo obſerved, that, by this Theorem, the Unciæ, or Coefficients, do only increaſe until the Indices of the two Letters become equal, or change Places, and then the reſt decreaſe in the ſame Order.

(2) A famous General having ſerv'd his King,
Long Time in Wars, and had victorious been;
For which his Service, with a pleaſant Smile,
Aſk'd of his King, one Farthing for each File
Of ten Men in a File, which he could then,
Make with a Body of one Hundred Men.
The King, conſidering his brave Actions paſt,
And ſeeming Modeſty of his Requeſt:
Gives his Conſent. To what will it amount
In ſterling Money? Take your Pen and count.

Thus $\frac{100}{1}\times\frac{99}{2}\times\frac{98}{3}\times\frac{97}{4}\times\frac{96}{5}\times\frac{95}{6}\times\frac{94}{7}\times\frac{93}{8}\times\frac{92}{9}\times\frac{91}{10}=\frac{62815650955520472000}{3628800}=$ 17310309456440 Farthings, or 18031572350£. 9s. 2*d.* *Q. E. F.*

(3) Two Gameſters one Day, at Dice they did play,
And being full merry with Wine;
Said B unto A, what odds will you lay
I caſt not the ſix Aces this time?
Says A then to B, ten to one I'll lay thee,
With ſix Dice, the ſix Aces you caſt not.
Pray youths ſhew, and here let them know,
For the Odds on the Caſt, Sirs, they do not.

First $6\times6\times6\times6\times6\times6=46656=6^6$ different Combinations.

And $1\times2\times3\times4\times5\times6=720$ Variations.

Then $46656-720=45936$ Chances againſt A.

But as A laid 10 to 1. ∵ 7200 Chances to B.

Therefore A's Chance to that of B, :: 45936 : 7200, or : 6,38 : 1. *Q. E. F.*

(4) Two Gameſters met the other Day,
The one call'd B, the other A;
But having neither Cards nor Dice,
They got to Hotch-cap in a Trice;
With ſixteen Halſpence, fair and flat,
All which they huſled in a hat:

Says A, to B, all theſe are mine,
And I will lay a Pint of Wine,
That in two Trials there will be,
Nine Heads or Tails, as here you ſee—
No Matter which, but on they play'd,
'Till Silver, Braſs, and Gold were laid:
But as to B, his Chance was bad,
For he got broke of all he had.
What were the Odds? I pray declare,
Ye ingenious Youths, and place it here.

Firſt $2^{16}=65536$, Number of different Chances on 16 Halfpence.

Now let *a* repreſent the Heads, and *b* the Tails.

Then (by Theo. in p. 328) we ſhall have $a^{16}+16ab^{15}+120a^{14}b^{2}+560a^{13}b^{3}+1820a^{12}b^{4}+4368a^{11}b^{5}+8008a^{10}b^{6}+11440a^{9}b^{7}$, &c.

Then $11440\times2=22880$ Chances for nine Heads, or Tails to come.

$\because$ $65536-2280=42656$, Chances, not come up the firſt Time, viz. 22880 to 42656, that they come up nine Heads or Tails the firſt Toſs.

Therefore as $65536 : 22880 :: 42656 : 14892\frac{7}{64}$.

Then $22880+14892\frac{7}{64}3=7772\frac{7}{64}$ for } Nine Heads

Alſo $65536-37772\frac{57}{64}=36763\frac{57}{64}$ againſt } of 9 Tails.

MAGICAL SQUARES.

By a Magical we underſtand a Square divided into ſeveral other ſmall equal Squares, filled with Terms of an Arithmetical Progreſſion, ſo tranſplanted, that all the ſame Line or Rank, whether taken perpendicularly, horizontally, or diagonally, make the ſame Sum.

EXAMPLE.

(1) The Numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9, being given, to form them in a Magic Square; viz. counting each Rank perpendicularly, horizontally, or diagonally, that theſe Ranks may be equal to each other.

Suppoſe it done, and repreſented in its proper Form, by the following Symbols, placed as follows,

$$\begin{array}{ccc} a & b & c \\ d & e & f \\ g & h & m \end{array}$$

Then by the Queſt. we have $\left.\begin{cases} a+e+m=15 \\ b+e+h=15 \\ c+e+g=15 \end{cases}\right\}$ required e the middle Numb.

Their Sum $=a+b+c+3e+m+h+g=45$.

Again $a+b+c=15$ } added together we get $a+b+c+m$
Alſo $m+h+g=15$ } $+h+g=30$; this taken from the fourth Equation gives $3e=15$.

Then $e=\frac{15}{3}=5$, the Middle Number.

Or by Numbers, thus,

Firſt the Sum of the progreſſional Numbers are $1+2+3+4+5+6+7+8+9=45$.

Then $3=$ the Number of Rows.

$\because 45\div3=15=$ the Sum of each Side or Rank.

And $15\div3=5=$ the middle Number as before.

Again, to find the corner Figures; and firſt to find the Figure repreſented by a. Beginning with 1, I find the corner Letter a, or any other corner Letter cannot be 1; for if a was $=1$, then m muſt $=9$, $b+c=15-1=14$; as alſo $d+g=15-1=14$. But there remains no two Numbers after 5, 1, and 9, whoſe Sum is 14, but 6, and 8.

Then if any of theſe Figures were b, the other would be c; and then no Figures would remain for the Value of either d or g; whereſore a is not equal to 1, nor any corner Letter $=$ to 1, or 9.

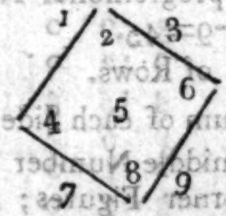
Now 3 cannot be $=a$; for if it were, then m ſhould be $=7$; and $b+c=15-3=12$, as alſo $d+g=12$: but there remains no two Numbers after 5, 3, and 7, whoſe Sum is 12, but $8+4$, which cannot anſwer to b and c, and d and g; whereſore a, or any other corner Letter, is not $=3$; neither is m, nor another corner Letter $=7$; from what has been ſaid, it is plain, that (if the Queſtion propoſed is capable of being ſolved) the corner Letters are all even Numbers; wherefore if $a=2$, m will be $=8$ and c muſt be either 4 or 6. Let $c=4$, then $g=6$, $b=9$, $d=7$, $f=3$, and $h=1$; and ſo the Square will be completed as was required.

2	9	4
7	5	3
6	1	8

But if $c=6$ (a being$=2$;) then $g=4$, $b=7$, $d=9$, $f=1$, and $h=3$, and then the Squares will ſtand thus,

2	7	6
9	5	1
4	3	8

Or they may be found mechanically: thus, ſet them all down progreſſively, about which draw a Square cornerways; thus,



Then ſet the four angular Figures at the Corners, and put the outermoſt alternately: that is, place 1 between 8 and 6, 9 between 4 and 2, 3 between 4 and 8, and 7 between 2 and 6; thus,

2	—	6
—	5	—
4	—	8

2	7	6
9	5	1
4	3	8

There are many Ways of conſtructing Magic Squares, as alſo many ſurpriſing Properties thereto relating, and it is in itſelf very curious and entertaining; yet it cannot be denied, but that it is of very little or no Uſe in any other Parts of the Mathematics; therefore, whoever would ſee more of theſe Matters, may conſult the DIARIAN REPOSITORY, Page 103 to 108, alſo from p. 225 to 233, where they will find this Subject more largely treated of.

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	2	17	0
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	26	8	10½

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	3	12	0
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(6)	0	17	0
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	0	17	6
	3	16	6
	0	10	6
	1	9	0
	8	19	9

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(7)	11	18	2¾
	14	14	8
	12	6	2¼
	4	2	4
	2	8	6¼
	4	12	7½
	50	2	6¾

	£.	s.	d.
(8)	0	18	0
	0	6	2¾
	1	0	0½
	0	14	0
	1	11	6
	0	16	3
	5	6	0¼

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(10)	23	0	9	(11)	0	4	3 ¼	(12)	3	7	0
	1	18	0		0	5	10		3	9	0
	39	18	0		0	18	4½		0	10	3¼ ½
	39	3	0		0	5	5¼		4	10	0
	35	18	0		0	9	9		1	11	6
	4	9	3		0	4	9½		10	0	0
					0	6	1¼				
	145	5	0		2	14	1½		23	7	9¼

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	1	3	0		4	13	11½ $\frac{4}{7}$
	1	11	6		7	9	0¾
	1	2	7¼		5	2	1½ $\frac{6}{7}$
	0	11	3		7	8	8½
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